FEBRUARY 25, 1939

ELECTRICAL WORLD

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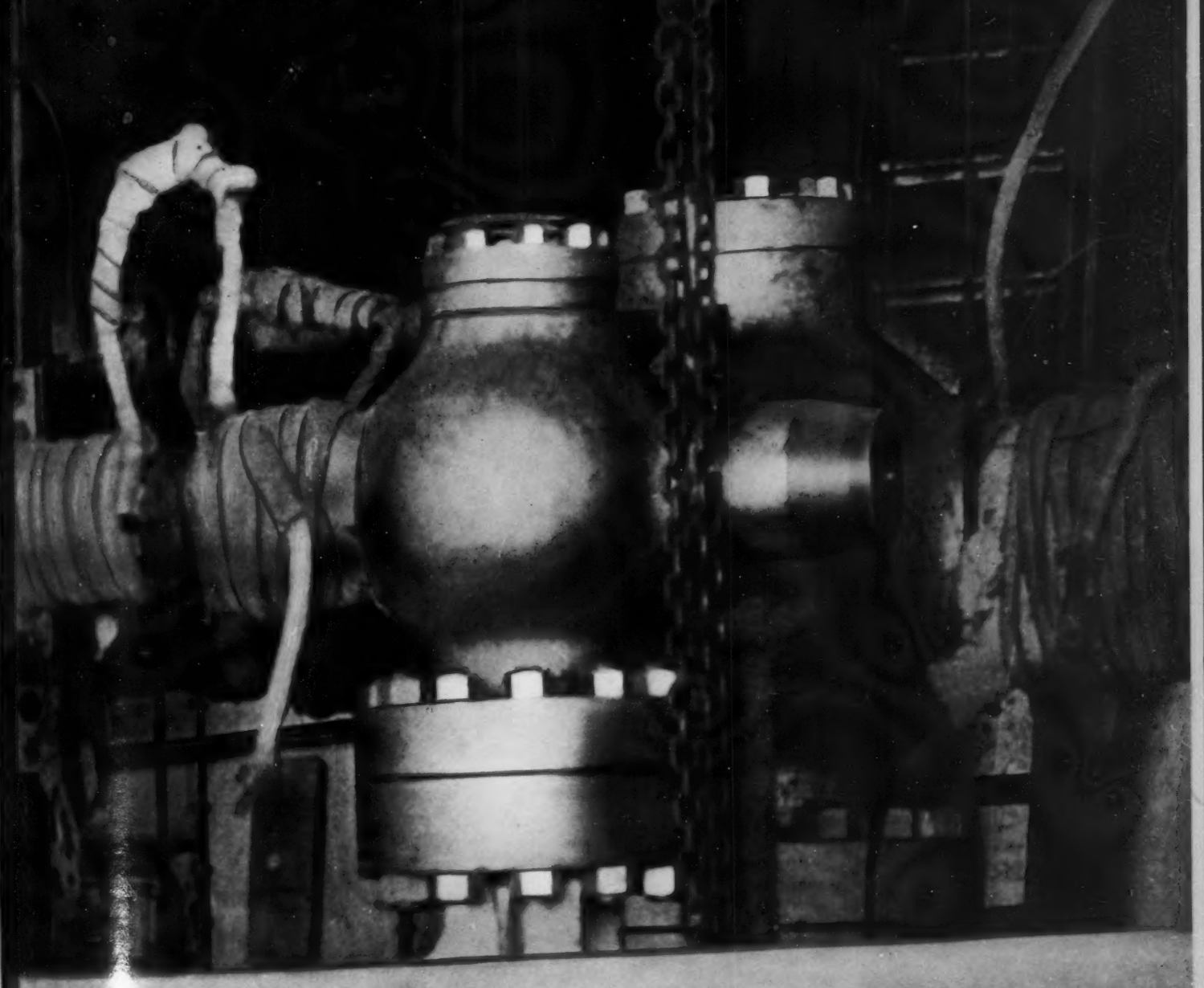

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A Basis for Confidence

At his press conference last week President Roosevelt is reported to have indicated that there was no longer any reason for utilities to hold back in their construction programs because of any fear of what the government might do. The implication was that there were no grounds now for misunderstanding between government and the utilities.

For the past year and a half the utilities have known, the President stated, that there was to be no further expansion of federally sponsored power projects. The very fact that the holding companies, with two exceptions, had registered under the SEC, according to him, was an acceptance of the constitutionality of the act and an acknowledgment that government and the utilities could work together. This new mutual understanding was further emphasized, the President indicated, by the pledge of co-operation by the utilities to purchase additional generating capacity as a matter of national defense.

This report in last Saturday's paper must have caused a great many utility executives to wonder where they had been during the past eighteen months, not to have known that the war which the government had been waging against them had been over all that time. In fact, many today are wondering if the President meant what the headlines and reports indicated.

While there is no need to itemize the several incidents of the past year and a half that were totally at variance with the idea that there was an understanding between the Administration and the utilities, one can't help wondering just what the President meant when he said that it had been known during that time that there was to be no further expansion of federally sponsored hydro developments.

Right now Congress is voting more funds for TVA expansion—an expansion that is expected to bring TVA competition into several important industrial areas outside of the Southeast. Did the President mean what he is reported to have said or did he have something else in mind?

In South Carolina, with the Santee-Cooper project, and elsewhere state power authorities are becoming interested in expanding public ownership through water-power developments with government financial aid. Did the President mean that federal subsidies of such projects could no longer be obtained or are we to take not the spirit of the report but the letter only? In that event, it might mean that henceforth the states will take over and continue in place of the government in hydro development—a distinction without any essential difference.

It was obvious from reading the report of what the President said that he felt there was reason for utility confidence in the Administration. In spite of the fact that there is nothing the utilities want more than to be in a position to have such confidence, the industry is far from believing that a sound basis for confidence exists. It is believed that there are several forces at work today which are bringing the time for confidence nearer, but there must be more tangible evidence of a desire on the part of government to work with the industry and not against it before it can recognize a state of peace.

The interval can be shortened by the President through the announcement of a federal power policy that admits of no equivocation. Partial statements such as made at his press conference are but momentary stimulants, the after effects of which frequently cause more havoc than if nothing had been said.

If this industry is to do its part in reviving the heavy goods industries it must have confidence in its government. It can have that confidence only when it knows what the government's power program really is.

Add Capacity, Reduce Hazards by Substation Redesign

By R. B. RICHARDSON and R. W. WILBRAHAM*

Operating Manager
Delaware Power & Light Company

Chief Electrical Engineer
United Engineers & Constructors, Inc.

SUBSTITUTION of a ring for the original parallel bus on the 66-kv. side of the Christiana substation of the Delaware Power & Light Company allowed an increase of capacity from 50,000 to 75,000 kva., reduced the number of 66-kv. breakers from nine to eight and provided opportunity for installation of effective protection against explosion and fire damage. At the same time the low (11 kv.) side of the substation, also a parallel bus, was changed to three parallel sections, one to a transformer bank, with tie breakers in only one side of the parallels. Diagrams below show the changes.

Early in 1937 it became apparent that the Christiana capacity was becoming inadequate to meet the system requirements. A thorough study of the several ways of increasing the capacity at minimum cost commensurate with maximum dependability of service established the fact that nothing was to be gained for either reliability or economy by establishing another substation. This, however, was very attractive from the standpoint of isolation, but was finally rejected as impractical.

* Condensation of paper presented at E.E.I. electrical equipment committee meeting, Buffalo, N. Y., February 6, 1939.

The final solution was to add a third 25,000-kva. transformer bank to the two similar banks already installed at Christiana. This introduced two major engineering problems which controlled the design in its entirety. These problems had to do with the increased rupturing duty imposed upon the 11-kv. feeder bus oil circuit breakers by the third transformer bank, and the oil fire and explosion hazard of the transformer banks and oil switches connected to the 66-kv. bus.

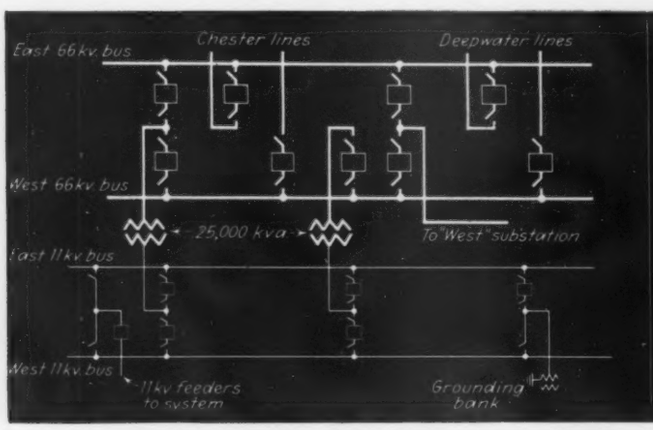
Protection against fire

Realizing that a serious fire or explosion at Christiana could cause a protracted "shutdown" to a large part of the company's system, it was determined that this substation should be rebuilt to incorporate the features necessary to prevent the spread of oil fires and the damage from explosions.

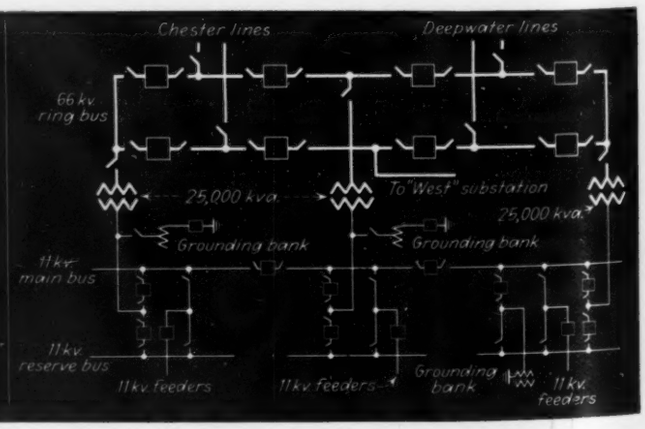
To remedy the faulty conditions several different methods were considered by the engineers of the company, the Philadelphia Electric Company and United Engineers & Constructors, Inc. The arrangement finally decided upon was a 66-kv. ring bus of long circumference, using the existing structures for one-half of the ring and cutting the 11-kv. bus into three sections, one section for each transformer bank.

The 11-kv. bus to which the system distribution feeders are connected was supplied by two 25,000-kva. transformer banks and equipped with one grounding bank. The 66-kv. structure consisted of eight 30-ft. bays, 41 ft. high and 50 ft. deep from front to back. The buses, although having normal separation for a structure of this type, were arranged parallel to one another and ran the entire length of the single integrated structure. The layouts of these structures, originally and as revised, are shown in the plan drawings.

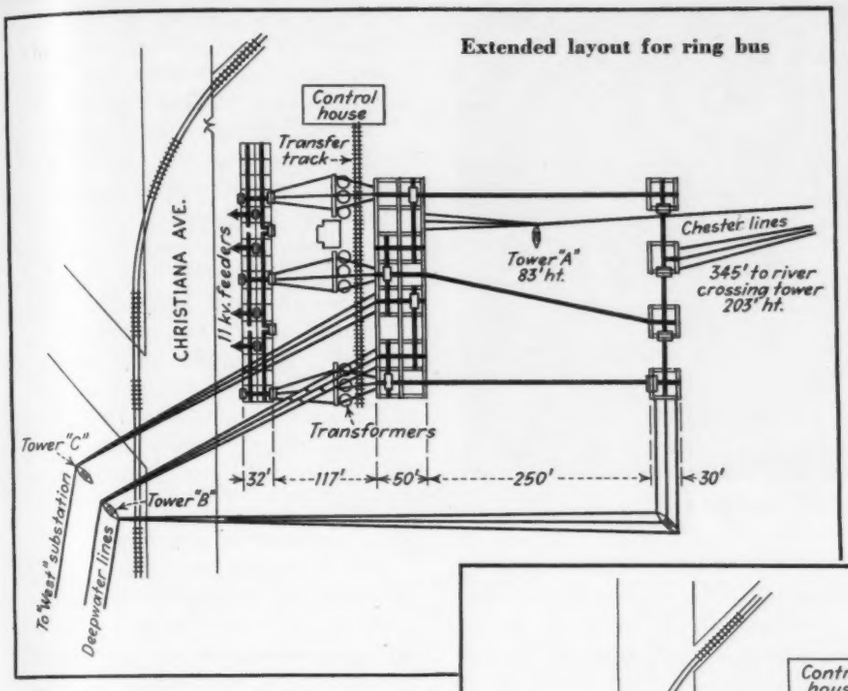
Except for the four incoming 66-kv. feeders, those bays having less than two oil circuit breakers would have two in the near future as a result of normal growth. This restricted the clearance between breakers, or breakers and instrument transformers, in most cases, to approximately 10 ft., as appears in the section drawing. and the "T" or paralleling connection point for the buses would have been directly over the breakers. Equally hazardous was the fact that the two Chester and the two Deepwater feed-



Original 66-kv. parallel bus



66-kv. bus revised to a ring



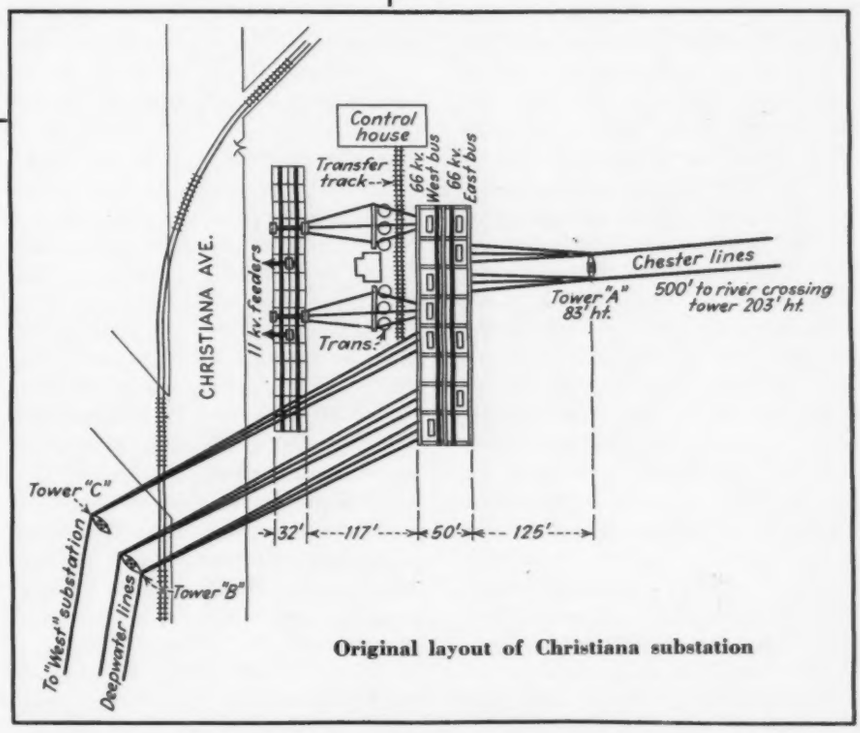
Extended layout for ring bus

ers terminated in adjacent bays at opposite ends of the structure.

The two original transformer banks are located approximately 60 ft. apart and 30 ft. from the structure and were not equipped with any fire-extinguishing system. Consequently, the potential hazards existing in the 66-kv. structure were decidedly serious. Failure of equipment on one bus could easily be communicated to that on the other bus, with the possibility of a general station interruption.

Not a part of this structure, but nevertheless entering definitely into any problem of rearranging the 66-kv. structure, was the location of the Deepwater and West substation 66-kv. structure, was the location of shown in the plan of the original layout.

The two Deepwater feeders dead end on one double-circuit tower (B) and one present and one future circuit to the West substation on a similar tower (C), and their spans into the substation cross a main highway, railroad and telephone and telegraph lines. Consequently, if these feeders were to be relocated in other bays of the structure to obtain greater separation it would require, for the Deepwater and West substation feeders, the crossing of one over the other and the building of an additional tower with many interruptions. It was doubtful if any solution requiring this would be satisfactory, and certainly the cost would be excessive.



Original layout of Christiana substation

For all of the following bus schemes which were studied it was decided that the only positive method of fire protection for the transformer banks was to install a complete "Mulsifyre" system:

Scheme 1—Contemplated the rearranging of the present bus and circuits so as to form a ring bus within the existing structure.

Scheme 2—Considered the building of a new structure in line with but separated from the existing structure and arranging the old and new bus and circuits so as to form a two-section, single bus with a tie switch.

Both of these schemes accomplished a certain measure of bus isolation, but not as completely as desired. Both required the very objectionable features of crossing the incoming feeders and so many extended interruptions that the system would be placed in an unsafe condition.

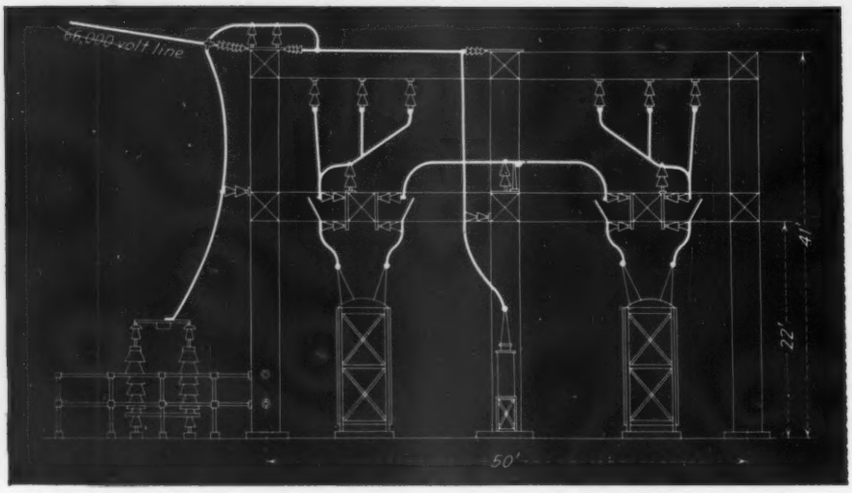
The estimated cost of each of these schemes was the same—$271,000.

Scheme 3—Considered rearranging the circuits and double bus in the present structure so as to form one bus of a double bus arrangement. The other bus would be in a new steel structure parallel with, but 250 ft. removed from, the present one.

This scheme had the merit that there would be little likelihood of oil or solid material being thrown from one bus to another, but a fire in any part of either structure might continue long enough to damage the insulation or involve other apparatus and make it necessary to take the bus out of service; also, and of most importance in that respect, was the fact that the tie lines between the two structures or buses were integral parts of the outgoing circuits and if the damage involved the bus insulation it would undoubtedly cause the loss of the circuits in the area affected.

The estimated cost of this scheme was $311,000.

Scheme 4—This was predicated on the basis that the incoming feeders



Bay section of original 66-kv. parallel bus

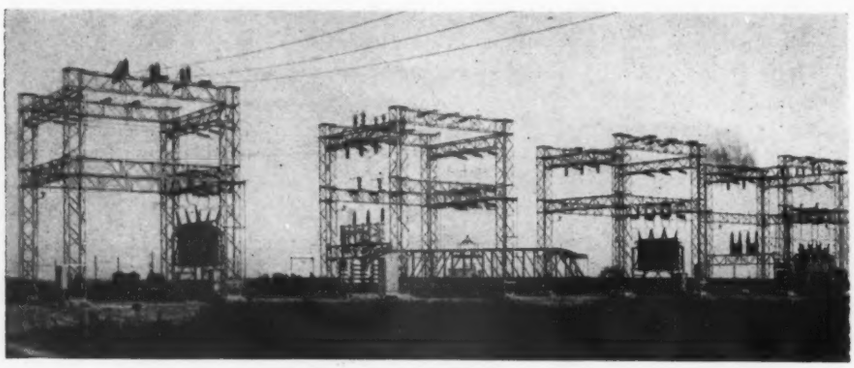
would not be crossed or moved. The existing bus and structure would be extended one bay, providing for the switching equipment for the new transformer bank, and a complete "Mulsifyre" system installed throughout the structure definitely to confine and to extinguish any fire. Accepting the fact that apparatus will fail, partial protection against the infrequent occurrence of flying material was to be provided by barriers extending from the ground to the cross girders, a height of 22 ft. These would be placed between the two bays serving the Deepwater lines and between the bays serving the Chester lines to prevent simultaneous trouble to both lines from one source. A barrier would be erected between the bays serving the transformer bank and the 66-kv. line to West substation, since here four oil circuit breakers were closely grouped.

This scheme was very attractive. It answered many of the requirements and had a low estimated cost of $271,000, but in final analysis the basic objection of congestion had not been remedied, with the result that the problem was further studied.

Scheme 5—This, the accepted scheme, was the ring bus of long circumference. It was made up of the original 66-kv. structure electrically rearranged, and a new section forming a rectangular ring 240 x 250 ft. The increased rupturing duty otherwise imposed on the 11-kv. bus by the addition of the transformer bank would be avoided by cutting the bus into three sections, one for each transformer bank. The estimated cost of this scheme was $350,000, of which there was $90,000 for the transformer bank, $21,000 for the "Mulsifyre" system and $14,000 for contingencies of an undeterminable nature.

In planning the layout it was endeavored to alternate the Chester and Deepwater lines in the ring because simultaneous circuit outages usually occur to parallel circuits on the same transmission line, but this refinement would have required the crossing of the 66-kv. lines in the terminal spans and involved more expense and construction hazards than were justified by its merits. A further reduction of potential hazards was obtained in that the schemes requiring extension of the parallel bus would have required a total of twelve breakers, whereas the ring bus required only eight. This is one less than the number used in the original bus.

The new structure required to complete the ring bus was built 250 ft. away on property already owned by the power company and consists of four towers, 30 ft. square and 40 ft. high, placed 40 ft. apart. The bus connection between them is by means of overhead single-conductor cables. The new transformer bank was installed in line with the original two, and the transfer track was extended so as to make available the heavy-duty hoist in the transformer repair house.



Towers for incoming lines

Precise co-ordination

For a reconstruction problem of this kind it was necessary that every item of design be precisely fitted to the construction requirements, which, in turn, must be the result of the most complete co-ordination with the operating needs, which were that the trunk line flow of low cost power from Deepwater to Chester be maintained to the greatest possible degree, that the Wilmington system, serving continuous process type of industries, should not suffer interruptions and that any outage be so planned that, in the event of some system emergency, substation equipment temporarily out of service could be restored in a few hours. To this end, and prior to the initiation of construction, a complete schedule of outages was prepared and approved by the operators. It not only provided the usual full information of date, time duration and equipment involved, but described certain non-outage conditions that might be quite properly termed "thin operating conditions" so that proper safeguards, such as additional standby, could be provided.

On this basis, meticulously carried out during construction, the entire project was completed without a faulty operation or accident among the working force. Due to later changes in combined system loading conditions, it was possible to complete, on straight working time, the greater part of the cutover work scheduled for overtime conditions. Minor reductions in the scope, and the non-use of the contingency item of $14,000 in the estimate, together with actual savings, reduced the total estimated cost of $350,000 to slightly under $300,000.

D.C. Transmission Evolving Only Slowly

*Though Economically Uncompetitive With A.C. Transmission, Test Line Shows Encouraging Technical Performance**

HIGH-VOLTAGE direct-current transmission is not an active competitor of alternating current in any situation where a.c. can function as an economically justifiable venture. In its present form it costs much more than the corresponding a.c. equivalent. As to the possibility of decreased costs, as might be expected with any new product, the proportion of standard equipment involved is large—equipment for which materially decreased costs were not indicated. A more likely solution to the cost problem lies in the possibility of further investigations resulting in new circuit arrangements for rectification and inversion, and in the possibility of changing future requirements.

Any future use of d.c. transmission can be expected to develop slowly, through step-by-step trial basis, and not as some cataclysmic revolution overthrowing electrical transmission as we know it today.

There are advantages

Considering first the factors which favor direct-current transmission in comparison with alternating current, four advantages are recognized:

1. One of the fundamental advantages of direct- over alternating-current transmission arises from the fact that, if two identical lines are to transmit power, one by direct and the other by alternating current, and if both lines are to operate with the same maximum insulation stress and if both lines are also to have the same efficiency of transmission, the direct-current line can transmit twice the power transmitted by the alternating-current line. This increase is possible by using a direct-current voltage equal to the maximum alternating-current voltage and a direct-current amperage equal to the maximum alternating-current amperage.

2. A second advantage for a direct-current system arises from the fact that fewer wires per circuit are required with direct current. There seems to be a good reason to expect that each wire can be operated as a circuit with direct current, whereas three wires are conventionally used with alternating current. A reduction in the number of wires may be expected to simplify the construction and reduce the cost of the line.

3. In the case of cable insulation, the safe working stress on direct-current lines is considerably above that on alternating-current ones. A direct-current stress three times the alternating-current working stress may be possible. This is to be expected because the power loss in the cable insulation is much less on direct current. In the case of overhead insulation there is not yet sufficient data on which to base reliable conclusions, but no considerable increase in insulation stress should be expected for overhead insulators, and the corona voltage will continue to be the limiting voltage at which the wires may be operated.

4. The use of direct current will permit greater flexibility between generating stations and will modify the problem of stability as it is met in alternating-current systems.

Against these possible advantages must be balanced some difficulties and disadvantages:

1. When the power is supplied by direct current, some provision must be made for wattless or reactive component of the load. Each direct-current transmission terminal station must include means for converting the direct-current power to carry the load and apparatus suitable for handling the reactive current of the load. Synchronous condensers are frequently employed to supply the reactive load in alternating-current systems, and this means would probably be used with direct-current transmission. The necessity of supplying the reactive at the local station does not, therefore, appear to be a great technical obstacle, though it is well known that more apparatus is required when the reactive and power components are handled separately than if they are combined.

There are weaknesses

2. The greatest liability of the direct-current system arises from the fact that two additional transformations of the power are necessary, first from alternating to direct current for transmission and, second, from direct back to alternating current for utilization. The success of a direct-current transmission will be contingent on the reliability and cost and efficiency of the two extra transformations. It is now customary to use several voltage levels in an alternating-current system, one for generation, another for transmission, a third for distribution and a fourth for utilization. Between each two voltage levels there must be a transformer. If direct-current conversion

* Excerpts from remarks by four General Electric Company engineers (D. M. Jones, C. H. Willis, M. M. Morrack and B. D. Bedford) at A.I.E.E. Metropolitan Section Power group meeting in Newark, February 16, 1939.

equipment can be made to approach a transformer in efficiency, reliability and cost, it may be possible to justify the two extra conversions by a saving in the transmission line.

Until recently the greatest technical obstacle to direct-current transmission using electronic converters has been the impossibility of making them function reliably at high voltage and large currents. This difficulty has been surmounted in the apparatus now available.

The experimental line

The installation under investigation has a full-load rating of about 5,000 kva. at 90 per cent power factor lagging load. The power is transmitted by 175 amp. at 27,000 volts direct current, and the output after conversion to alternating current is fed directly into a 13,200-volt, three-phase, 60-cycle system. This particular installation has been in operation more than two years and detailed operating records have been kept. The circuit has two rectifiers and two inverters connected in series. Use of a series, rather than multiple or parallel, system offers several advantages. Such a system is well adapted for high voltage and switching is far easier. Short-circuit becomes the normal no-load condition, and circuit protection is accomplished by closing rather than opening a switch, an important consideration when high-voltage direct current is handled.

A series system must be essentially a constant-current system. There are several methods of converting between constant potential and constant current. The method employed in the equipment now operating is a combination of inductive and capacitive reactances, frequently called a monocyclic network.

This network not only converts constant potential to constant current but also has the property of reversing the power-factor angle. This second property is desirable because an inverter using natural or phase commutation can supply only a load which is leading in character. Therefore, when an induction motor load is supplied through a monocyclic network the induction motor load appears to the inverter, on the opposite side of the monocyclic network, to be leading in character.

By the use of monocyclic network the inverter is adapted to supply the inductive loads found on commercial systems. It is, of course, necessary to have sufficient static capacity in the monocyclic network to effect the necessary change in power factor.

Series system stable

A third advantage associated with the series or constant-current system is the fact that inverters operating on constant current have been found far more stable than those operating on constant potential. The superior operation of the constant-current inverter arises from the ability to ride through tube faults with very little disturbance. When an electronic converter is operating at a reasonably high voltage (3,000 or more), there are occasional commutation failures. That is, some tube occasionally fails to direct the current to the correct circuit. This is often described as a loss of control in an inverter, or as an arc-back in a rectifier.

In the case of a converter operating from a constant-potential source this loss of control results in an abnormally large current, and a shock to the apparatus and the alternating-current system. In case the converter is operating from a constant-current system the loss of control does not cause an abnormal current. The voltage collapses and, after a hesitation of one or two cycles, the converter automatically resumes operation and the load is gradually restored to normal.

Lightning experience good

When a direct-current line is shorted or becomes grounded the rectifier forces normal current through the fault, while the inverter supplies approximately an equal current in the opposite direction. The current flowing in the short is a difference current and with normal circuit regulation is between 15 and 20 per cent of the normal line current, not a destructive current.

In the shorted condition the line voltage drops to zero and when the fault is removed several cycles are required for the monocyclic networks to oscillate up to normal voltage. This slow voltage recovery combined with a small short-circuit current is a characteristic of this constant-current system which results in the very rapid clearing of lightning faults and line-insulator flashovers. When lightning strikes the line, an insulator spills over and allows the surge to pass to ground. The voltage is now too low to maintain a small dynamic follow current over the surface of the insulator, so unless the insulator has been damaged by lightning recovery will start immediately.

During the past two lightning seasons each of the 147 towers of the line were equipped with surge current indicators of the magnetic link type. A total of nineteen direct strokes were recorded with indicated tower currents up to 68,000 amp., and in all cases the system recovered automatically to full load in 10 to 15 cycles without a single operation of protective oil circuit breakers.

Recovery after flashovers

Flashovers apparently resulting from faulty insulators, occuring particularly in wet weather when the system is operating at heavy loads with corresponding high transmission voltage, cause only momentary interruptions. Should such faults occur too frequently, it is only necessary for the operators to drop a little load, thereby lowering the transmission voltage below the flashover value, and go on transmitting power. A decrease of from 300 to 500 volts in the direct-current voltage usually overcomes the trouble.

Life of the tubes used in direct-current transmission is still to be determined. After two years of use all of the twelve rectifier tubes are still in service, as are eight of the original twelve inverter tubes. Three of the latter were replaced by tubes having a changed structure and one was removed for destructive examinations and tests.

The tubes being used are of the hot cathode, mercury-vapor type, carrying an average current of 60 amp. and at full load subject to voltages of 16,000 to 18,000 volts, depending on the power factor of the load. The inverter tubes have grids surrounding the anodes, but the grids were omitted from the rectifier tubes to avoid feed back. Such tubes are highly efficient converters of electric power. At full load one handles more than 400 kw. of power with a $1\frac{1}{2}$-kw. loss—about 0.3 of 1 per cent, or a tube efficiency of 99.7 per cent.

It was emphasized that, when used most effectively, tubes are smaller in size, lighter in weight and more efficient than other apparatus of comparable rating.

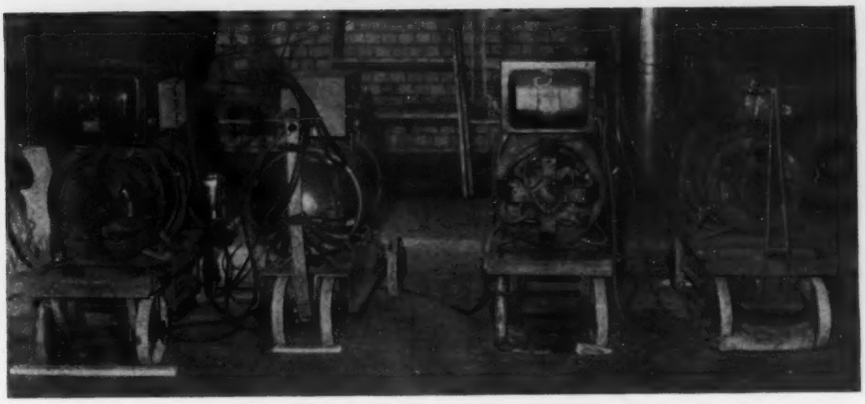


Fig. 1—Battery of electric welding units used on L Street piping

Pipe Welding at "L" Street

Electrical Methods of Preheating, Welding and Stress Relieving Carefully Worked Out—High and Medium Pressure Lines Offer Special Opportunity for Economical Application of Field Equipment

By LEWIS P. GOVE

Engineer Mutual Boiler Insurance Company, Boston, Mass.

FOR the higher pressure and temperature pipe lines of current power plant designs several methods have been used to establish that each welded joint shall be as nearly perfect as possible. The X-ray and the Gamma-ray are used for such investigation, but the cost of these methods is considerable, and unless chill rings are removed from the inside of the pipe false interpretation of the films may result, so that the chipping and rewelding may simply add unnecessary cost. Further, the two walls of pipe are taken on the one film, so that false readings may again be the result.

An alternative method is to make sure that every last detail is completed in strict accordance with the specifications, which means that there must be an engineer or inspector present at all times when there is any welding work in progress, including preheating, stress relieving and applying the hydrostatic test.

For the high-pressure piping systems in the "L" Street station extension of the Boston Edison Company, installed in connection with steam-generation units Nos. 74 and 76 and the No. 12 steam turbine-generator, an inspector of welding was present at all times. He covered the 1,300-lb. steam lines, boiler feed discharge lines, intermediate 300-lb. pressure steam lines, boiler blow-off lines and free blow and high-pressure by-pass lines. Steam is generated at 1,400 lb. gauge and 910 deg. F. total temperature and the turbine exhausts at 300 lb. gauge, 625 deg. F. total temperature.

Qualifications for welders

The welders were certified in accordance with the tentative requirements as adopted by the American Welding Society and revised in June, 1937.

In addition to the certification, a check of each welder was made on the job by having a specimen welded and stress relieved under the observation of the inspector. This specimen was then X-rayed and samples were subjected to tensile and bending tests.

Valves and flanged joints

The bodies of all valves in the 1,300-lb. steam lines and in the boiler feed discharge lines are cast carbon molybdenum steel. All valves in the 1,300-lb. steam lines, all free blow and by-pass valves and those in the main runs of the boiler feed discharge and some of the valves in the blow-down lines are welded into the lines. Valves in the intermediate 300-lb. pressure steam lines have cast carbon steel bodies with flanged ends.

There are no flanged joints in the

Fig. 2—Typical finished vertical weld in 20-in. turbine exhaust

1,300-lb. steam lines except the two at the stream chest on the turbine, which can be classed as an integral part of the unit. There is one exception to this statement. All valves are fitted with bolted bonnets and each of these has a gasket. The control valve and check valve in each boiler feed pump discharge branch have Sargol joints. Also, the boiler feed control valves in each feed line to the boiler have Sargol joints. In addition to these, the joints in the boiler feed lines to the economizer inlets and from economizer outlets to the drums, those in the water column connections, in the feedwater regulator control connections, water level recorder connections, superheater drains, blow-off connections at the drums and water wall headers all have Sargol joints. As a result, the entire 1,300-lb. main steam line and the main runs in the boiler feed discharge lines and in the blow-off lines are welded throughout.

The intermediate 300-lb. pressure steam lines have a combination of welded and flanged joints. The 20-in. turbine exhaust to the existing 300-lb. main steam header, the 16-in. cross-connection in the existing boiler room and the 16-in. supply line from the 10-in. desuperheater have welded joints on the runs with gasket type flanged joints at the valves and at a few other connections.

All safety valves are fitted with flanges for gasket joints.

Pipe and fitting specifications

Specifications covering the pipe in the different systems are quoted as follows:

> Main steam piping shall be of seamless carbon molybdenum steel pipe in accordance with A.S.T.M. Specification No. A-206-37T with supplementary requirements, normalized and drawn, and of a thickness conforming to A.S.A. Standard Dimensions Schedule No. 160.
>
> High-pressure feedwater discharge piping shall be carbon steel pipe in accordance with A.S.T.M. Specifications No. A-160, with supplementary requirements and A.S.A. Dimension Schedule No. 160.
>
> Intermediate pressure steam lines cover all lines operating at a pressure of 300 lb. This piping shall be in accordance with Schedule No. 30-40, A.S.T.M. Specification A-106, Grade "B."
>
> Blow-off piping shall be from pipe made in accordance with A.S.A. Standard Schedule 80 and A.S.T.M. Specification A-106, Grade "B."

Fittings are forged carbon molybdenum steel for the main steam lines; forged carbon steel for the boiler feed discharge lines; cast-steel in accordance with A.S.A. Standards B-16, 1932, for the intermediate pressure steam lines, and forged steel A.S.A. Standards B-16 and A.S.T.M. Specifications A-95 for the boiler blow-off lines.

Welding specifications

All joints were welded with the electric arc method using coated rods. Chill rings of carbon steel were used in lines 5 in. in diameter and larger. They were of the solid type for the pipe with the greater wall thickness and the split type for the thinner walled pipe.

On both the carbon molybdenum steel pipe and the carbon steel pipe the welding procedure consisted of laying an initial bead of *Fleet Weld No. 5* in the weld groove. This was to insure good penetration into the chill ring. Welds in the carbon molybdenum pipe were then made with succeeding beads with *Murex No. 50* rod. Welds on the carbon steel pipe were made in the same way with *Fleet Weld* rod used throughout Each bead of weld metal was carefully cleaned and roughened after it had been deposited. The inspector was present at the beginning of each weld and checked the weld after each bead had been cleaned and roughened. Each weld was finished with a final heat-treating crown bead, also of *Fleet Weld*, laid above the normal surface of the pipe.

Joints between cast carbon molybdenum steel valve bodies and carbon steel pipe in the boiler feed discharge mains were welded in accordance with the specifications for the welding of all the joints in the carbon molybdenum steel pipe.

Joints in the carbon molybdenum

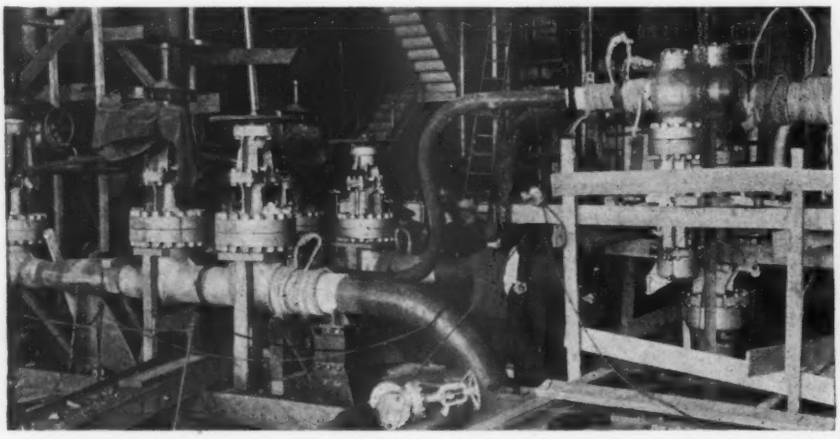


Fig. 3—Main turbine lead (14 in.), with 10-in. and 6-in. branches to reducing valves for 300-lb. supply, showing three completed joints and, in left-center, a joint prepared for stress relieving

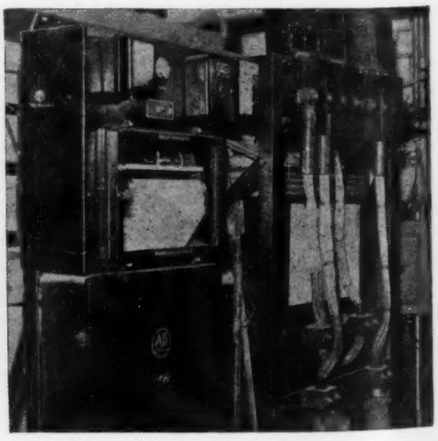


Fig. 4—Control panel with pyrometer, regulator, transformer and adjustable connections for variable voltage application to preheating and stress relieving

Fig. 4—In heating by induction from turns of copper cable wrapped around pipes, valves and fittings, with asbestos paper insulation between coils, extremely uniform results are obtained, temperature control is easily effected by varying the applied voltage and cutting current on or off and overheating is prevented by carbon molybdenum steel becoming non-magnetic between 1,350 and 1,400 deg. F., so that in such case the transformer begins to draw excessive current, opening fuses or circuit breakers.

steel pipe 6 in. in diameter and larger were preheated with an electric induction unit to a temperature between 400 and 600 deg. F. before starting the weld. The pipe adjacent to the weld was then held at this temperature during the welding process. When it was impossible to complete a weld within the authorized work period the weld was thoroughly wrapped with an asbestos blanket to prevent chilling or sudden cooling.

Joints between the cast carbon molybdenum steel valve bodies and the carbon steel pipe in the boiler feed discharge lines were preheated in the same manner as those on the carbon molybdenum steel pipe.

The carbon molybdenum pipe of the smaller diameter for the free blow and by-pass lines had the joints preheated by gas flame before starting the welds.

On the joints in the carbon steel pipe the preheating was done with the gas flame to a temperature between 150 and 350 deg. F. This temperature was maintained as near as practical throughout the welding of the joint.

Stress relieving

The specifications stated that all welded joints in steam and water piping sizes 5 in. and larger shall be stress relieved where the service pressure is above 250 lb.

All welds in the carbon molybdenum steel pipe were heated to 1,200 deg. F. with the electric induction heater and held there for two hours per inch of thickness. In view of the fact that the 14-in. pipe was 1.406 in. thick, this meant that the heat was held at 1,200 deg. F. for three hours for this size joint and for 2¼ hours for the 10-in. pipe, which was 1.25 in. thick.

All welds in the carbon steel pipe were held at 1,200 deg. F. with the electric induction heater for one hour per inch of thickness. In both cases heating was followed by cooling to 600 deg. F. through the medium of the electric unit, then allowed to cool in still air to room temperature.

The preheating and stress relieving were applied and controlled by a portable type unit so that the temperature was properly regulated when applying the heat, and also in cooling the joint. All work of installing the unit and the application of the heat was under the direct supervision of the contractor. There were two recording pyrometers connected to the unit, one of which controlled and recorded the preheat temperature and the other one controlled and recorded the stress-relieving temperature. When the work progressed sufficiently so that the stress relieving was getting behind the preheating and welding the preheating unit was converted into a stress-relieving unit which had sufficient capacity to take care of two of the welds of the small diameters. When a joint was prepared for preheating, the electric connections, including the leads for the pyrometers, were arranged so that the one set of connections would serve for both preheating and stress relieving.

Records and testing

The form (Fig. 5) on which inspection of the welded joints was recorded apparently has worked out very satisfactorily. The complete story of a joint from start to finish is covered on one sheet, except, of course, in the event that the stress relieving is delayed a few days after the completion of the weld, when a partial record is made for the later date.

After the completion of the line and after all joints had been stress relieved and cooled to room temperature the line was tested under a hydrostatic pressure of one and one-half times the operating pressure indicated on the valves.

Man-hours per joint

No attempt was made to compare the cost per joint on the welding with flanged joints of previous work. It is yet too early to get a comparatively accurate cost on the "L" Street extension. The contractor, therefore, furnished a set of costs which is considered average, taken from field costs of several of their previous installations. These costs, shown in the following table, are given in man-hours so that they may be applied in any community regardless of labor conditions:

Diameter of Pipe	Wall Thickness	Man-Hours Per Joint
6 in.	0.750	16
8 in.	0.906	20
10 in.	1.25	28
12 in.	1.312	44
14 in.	1.406	56
16 in.	0.750	36

The above represents actual field time for welding of carbon molybdenum pipe joints, exclusive of superintendence, handling of the pipe in place, tools, costs of welding energy and home office expenses. It was found that the preheating and stress relieving required an average of 15 man-hours. However, this does not give a true indication of cost, and further investigation brought out the fact that the average cost per welded joint is $27, exclusive of cost of energy, superintendence and general office expense. The remaining item of cost is the inspection, which is approximately $8 per weld. These figures are taken from the tabulation on the "L" Street job and show an average cost per joint where there were two welding crews per joint, so that this particular item may vary considerably, depending on the circumstances.

BOSTON EDISON COMPANY
"L" STREET - STATION No. 4

LINE Dr. of P. SIZE 10 inch DESIGNATION (A120 Chrome Moly)
WELDER 331 & 314 WELDER'S HELPER 312 ELECTRODE Jetarc A-50 Dia"
WELD STARTED 12:30 WELD FINISHED 10:45 BEADS NO. 13
DATE Sept 26,27, 1938 INSPECTION R R Kennedy
REMARKS:

PIPE TEMPERATURE

Half-Hour Periods	Original Heat	Reheat	Stress Relieving	
	Temp. Deg. F.	Temp. Deg. F.	Time Started	Temp. Deg. F.
1. 12:30....	455	...	8:00	50
2. 1:00....	475	...	8:30	500
3. 1:30....	470	...	9:00	900
4. 2:00....	450	...	9:30	1020
5. 2:30....	475	...	10:00	1200
6. 3:00....	550	...	10:30	1200
7. 3:30....	560	...	11:00	1200
8. 4:00....	470	...	11:30	1200
9. 4:30....	450	...	12:00	1200
10. 9:00....	...	440	12:30	1170
11. 9:30....	...	445	1:00	1040
12. 10:00....	...	450	1:30	900
13. 10:30....	...	405	2:00	780
14. 11:00....	...	450	2:30	650
15.	...	...	3:00	600
16.	...	...	...	...

MUTUAL BOILER INSURANCE COMPANY OF BOSTON

Fig. 5—Form used in recording data on electrically heating pipe joints for welding and stress relieving on L Street station job

The date, welder's number, the number assigned to the joint, the pipe line, the rod used, the time of starting and completing the weld and the inspector's name are at the top of the form. The preheat temperature and the stress-relieving temperatures are recorded at half-hour intervals. In a case where the joint cannot be welded completely during the regular work period the repreheating is also recorded.

Are Electric Ranges Profitable?

Analytical Method Reveals Wide Field for Electric Range and Complementary Benefits of Water Heater

By H. A. SNOW

Controller the Detroit Edison Company, Detroit, Mich.

IN THE article on this subject in the preceding issue of ELECTRICAL WORLD we presented estimated costs of serving an electric range. The summarized costs are repeated on the opposite page for the convenience of the reader.

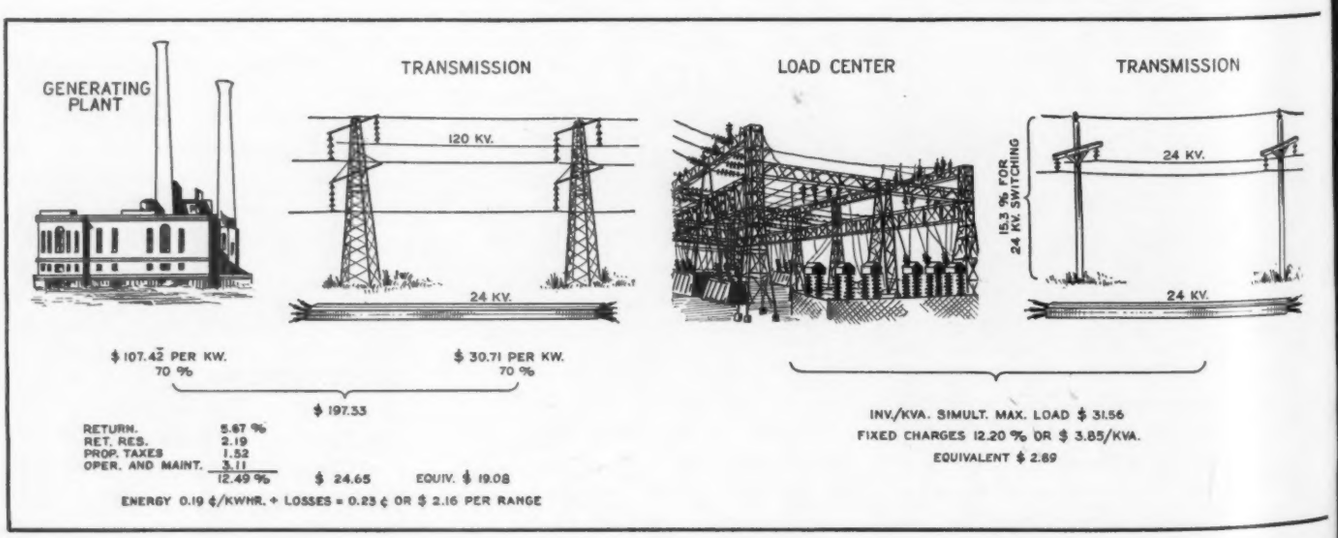
Referring to the summarized costs, let us consider the first four items whose sub-total is $28.17 a year. They are the cost of power houses, transmission, substations and feeders, and they are predominant, since they are 76 per cent of the total. The costs as figured make no allowance for the fact that equipment may be used by other classes of service at other times of the day, such as lighting in the later evening or power in the daytime. They are the costs of a central station system serving ranges only. In the jargon of the cost accountant, no allowance has been made for diversity.

Of course diversity exists. Of course it is possible to charge a part of the annual costs of generating equipment to something else besides the range service. We do not here refer to navigation or flood control, but to the fact that it is almost always possible to share the cost of generating equipment with other classes of electric service. As to how much discount for diversity may be given, we can only say that it depends upon the magnitude and timing of the loads imposed by other classes of service and that these loads change from time to time. Theoretically the discount may be anything from 100 per cent, if the range load is completely off-peak, to nothing at all if the range load is on-peak or if it is the only load carried, or if it is the predominant load, so that the range peak determines the system peak. The latter condition is interesting. If there is too much range load no diversity discount can be given because the range load dominates the system and it would be necessary to buy turbine capacity to serve range load exclusively.

Diversity governs

If no account for diversity is permissible rates must be somewhere between 3 cents and 4 cents per kw.-hr. But if there be a valley from 6 to 6:30 p.m. and if the range business does not overflow the valley, it will be profitable at so low a price as 0.9 cent or 1.0 cent. The permissible allowance for diversity is a predominant factor in range costs.

Note the cost of generating capacity is much larger than the cost of



Symbolical representation of method followed in assigning range service costs to the various elements of plant. Figures shown represent first step in process of estimating charges and are

transmission, substation and feeder capacity. Fortunately the chance of a high diversity discount is better at the power house than at the distribution feeder, because the range peak is likely to coincide with the lighting peak on the feeder, and it will be partly coincident with the substation and transmission peaks. This is especially true in a large city in northern latitudes, where the entire area served by a substation (with its trunk lines) may be homogeneously residential.

If we are to guess at range costs, we must assume a discount for diversity. Suppose that in the last four years two system peaks have occurred at 10 to 10:30 o'clock in the morning and two system peaks at 5:30 to 6 o'clock in the early evening. At 10 to 10:30 a.m. the range load is low, 33 per cent of peak values according to one published curve and 26 per cent according to another. At 5:30 to 6 p.m. it is high, 95 or 90 per cent of peak. The average of the four figures is 61 per cent. If it is reasonable to charge 61 per cent of the power plant, transmission, substation and feeder costs to the range and to collect 39 per cent from other classes of service we have a corrected sub-total of capacity costs of $17.18. This is approximately the capacity charge required by the peak responsibility theory.

Note that the figure is a statistician's average. The cost of the first few ranges served is apt to be quite low, of the next group the cost will be higher, and if a range peak develops the last ranges added will increase the utilities' expenses disproportionately.

To the cost of capacity after correction for diversity must be added the cost of coal, line transformer, service connection, meter, uncollectible bills, the federal excise tax and service repairs, to obtain a total of $26 per range per year.

This total takes no account of overhead expenses, such as the cost of warehouses, shops, garages, a telephone system, a research laboratory, or the cost of general offices, an executive staff, a legal department, an accounting department, or the cost of general advertising and business promotion, or the federal income tax or the cost of a stock of coal and materials on hand and a supply of cash in bank. Suppose that the total of all such items amounts to 19.84 per cent of all direct expenses. How can a fair share of overhead expense be assigned to range business?

Overhead charges

Of course overhead expenses may be spread over direct expenses with a slide rule, as mortar is spread with a trowel. But overhead expenses by definition are expenses which are not proportional to anything. What, then, is the logic of prorating them to something? It is undeniable that the total overhead expense must be collected somehow from the total business done, but there is no requirement that any one class of business be assigned a specific burden of overhead. Equity may suggest a uniform percentage, but if the addition of 19.84 per cent to previously estimated direct costs produces a calculated cost of range service so high that it cannot be sold in competition with gas, then the suggestion is impracticable. It is impracticable in the operation of an electric company, a gas company or the corner grocery.

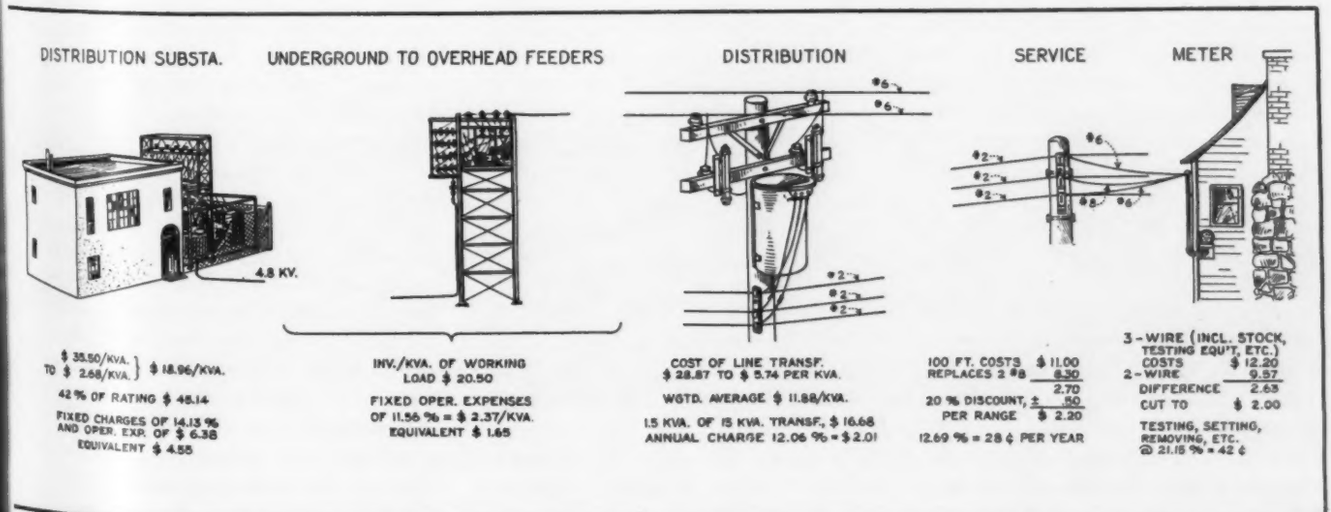
Overhead expense in any business must be assigned by management where it can be earned in the face of competition, and every class of service must contribute something toward the total. After these two requirements have been stated there is nothing more to be said.

Then let us consider how much overhead can be earned in the face of gas competition. Suppose that it takes 50 kw.-hr. in an electric range to do the cooking which can be done by 1,000 cu.ft. of 530 B.t.u. artificial gas in a gas range, or that 83 kw.-hr. is equal to 1,000 cu.ft. of 1,000 B.t.u. natural gas. Suppose that the artificial gas costs 77 cents a thousand and

Table II—Summary of Costs
Without allowance for diversity

Capacity Used in Common by Several Classes of Service	Annual Cost per Range	
Turbine capacity	$19.08	
Transmission	2.89	
Distribution substation	4.55	
Distribution feeder	1.65	
Sub-total	$28.17	
Other Items		
Coal (for 939 kw.-hr.)	$2.16	
Extra line transformer capacity	2.01	
Three-wire service connection (extra cost)	.28	
Three-wire meter (extra cost)	.42	
Uncollectible bills	.07	
Federal excise tax	.82	
Servicing	3.06	
Sub-total	$8.82	
Grand total		$36.99

before correction for diversity, overheads or complementary load balancing. These data are not to be taken as representative of the costs of any specific utility anywhere.


DISTRIBUTION SUBSTA.
UNDERGROUND TO OVERHEAD FEEDERS
DISTRIBUTION
SERVICE
METER
4.8 KV.
$ 35.50/KVA. TO $ 2.68/KVA. } $ 18.96/KVA.
42 % OF RATING $ 48.14
FIXED CHARGES OF 14.13 % AND OPER. EXP. OF $ 6.38 EQUIVALENT $ 4.55
INV./KVA. OF WORKING LOAD $ 20.50
FIXED OPER. EXPENSES OF 11.56 % = $ 2.37/KVA. EQUIVALENT $ 1.65
COST OF LINE TRANSF. $ 28.87 TO $ 5.74 PER KVA.
WGTD. AVERAGE $ 11.88/KVA.
1.5 KVA. OF 15 KVA. TRANSF., $ 16.68
ANNUAL CHARGE 12.06 % = $ 2.01
100 FT. COSTS $ 11.00
REPLACES 2 #8 8.30
2.70
20 % DISCOUNT, ± .50
PER RANGE $ 2.20
12.69 % = 28 ¢ PER YEAR
3-WIRE (INCL. STOCK, TESTING EQU'T, ETC.) COSTS $ 12.20
2-WIRE 9.57
DIFFERENCE 2.63
CUT TO $ 2.00
TESTING, SETTING, REMOVING, ETC.
@ 21.15 % = 42 ¢

the natural gas $1.43. Under these assumptions gas cooking would cost $14.50 and $16.20 respectively a year. Our philosophy requires that each class of service contribute something toward overhead expenses, and competition will not permit too large a burden. Suppose that for the purposes of this discussion, for a product still in the development stage and without any consideration given to the possibilities of the range-water-heater combination, we add 5 per cent to direct expenses for overhead. If direct costs are $26, a 5 per cent burden for overhead would bring the total to $27.30, or 2.9 cents per kw.-hr. Remember, however, that costs may be anything from 0.99 cent to 4.14 cents per kw.-hr., depending on our ability to fit the range load into valleys in the loads imposed on the system by other classes of service.

Development expense

Promotional expenses incurred in pushing the electric range during the various development stages may reach impressive figures. Suppose that the average range purchased wholesale for $73 is sold installed for $110 and suppose that the trade-in allowance on the old range takes $12 of the gross profit. This would leave a difference between wholesale and net retail prices of $25. From this must be paid an assumed selling expense of $21 and a delivery expense of $4. This leaves no margin for advertising ($6) and demonstration ($4). In addition, it may cost the company $25 to rewire the customer's house for range service. Under these assumptions, which impose all these expenses on the utility, the loss of demonstrations, advertising and wiring would eat up gross receipts from the sale of energy for the range for a year and three months and net receipts for about four years. Of course we should remember that promotional expense is justified to popularize the electric range in the early stages of its adoption; later on, when every one cooks electrically, it may not be needed. The wiring expense at least is not repetitive, since a house once wired is always wired. But the promotional costs hinted at above suggest the desirability of a somewhat wider margin between the cost of range energy and its final sale price. New business costs, whether to promote range business or other business, are a part of overhead expense and we have included a burden of overhead in our assumed range costs, so that the calculated cost of $27.30 per range per year already includes an item to cover in part these promotional expenses.

Cost figures can never be exact. There are always two items of cost wherein judgment must take precedence over arithmetic. The less important item is the assignment of a burden of overhead expense. The more important one, and one which may swing the cost determination from 0.99 cent per kilowatt-hour to 4.14 cents, is the estimated allowable discount for diversity based on a knowledge of system loading. By and large, range service can be profitable at rates competitive with gas service if the equipment needed to generate and transmit energy can be kept busy at other tasks when it is not needed for range service. In short, the development of range business need only keep pace, be that pace fast or slow, with the development of other business so that the system load factor remains high. The better the range load fits into the valleys the lower its cost will be.

We recognize that growth in range load, to be profitable, must be accompanied by balancing growth in other loads, but in actual practice growth is rarely accomplished with exact balance. A permanent and pronounced range peak would be something to worry about, but a small range peak poking its nascent nose above the level of all-day loadings means only that the first step is being taken toward larger sales. Later on, growth in other types of load will again restore a satisfactory load factor. It is not wise to let statisticians and their computations induce commercial paralysis.

Water heater benefits

Realizing that range load unaccompanied by other loads may not be profitable at competitive rates, utility sales managers have long sought for other loads to balance the range load. Many times it has been suggested that the controlled water heater with the range would furnish a profitable combination and no discussion of range costs would be complete without comment on this suggestion.

To be competitive with gas water heaters, energy for electric water heaters must not cost the customer more than 1 cent per kilowatt-hour, and even with high load factors on-peak electric service cannot be supplied at so low a price with profit. Therefore electric water heater service must be controlled by a time clock, or otherwise, so that the heater does not increase system peaks. So controlled, the increment cost is less than half a cent a kilowatt-hour, the service is profitable and it helps to carry the general burden of expense. The question then is, does the combination of an uncontrolled range and a controlled water heater possess cost advantages not possessed by either appliance alone.

The answer is yes

The answer is yes. While controlled water heating service is intended to be given from lines, substations and from power houses already in place, the controlled water heater, taking, say, 2,000 watts, cannot be served with the two-wire equipment already in place to furnish energy for lighting and small appliances in the average home. It is necessary to change the two-wire service connection and meter to three-wire equipment and probably to increase distribution line and transformer capacity. If this has already been done to take care of a range it need not be repeated for the water heater.

The advantage of the combination of range and water heater is local; that is, it is limited to the service connection and meter, the line transformer and perhaps to the distribution line. It rarely carries back to the substation, and never to the transmission and power house. The greater the saturation of water heaters the further back the advantage goes. Since diversified range load averages 600 watts per range, diversified residence lighting 300 watts per house and controlled water heaters take 1,500 to 2,000 watts, there should be only about half as many water heaters as ranges for the best balance of off-peak and on-peak load on the local distribution system.

In conclusion, what we have attempted here has been to appraise electric range costs, using assumed figures, and to discuss the possibilities of the combination of an electric storage type water heater with the electric range. And may the Recording Angel and the Federal Power Commission forgive me for using three significant digits for electric cost figures when the averages and prorations and assumptions back of the figures do not authenticate such apparent accuracy.

Frequency Converter, Completely Automatic Start

25,000-Kva., 25/60-Cycle Unit Paralleled With Others in Steel Plant Automatically Started, Speed-Controlled and Synchronized

By F. O. SCHNURE and H. BANY

Electrical Superintendent, Sparrows Point Plant, Bethlehem Steel Company

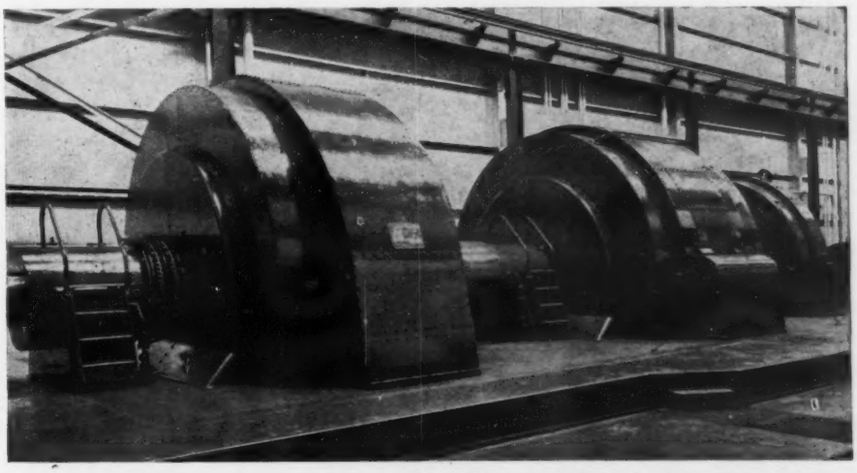
Switchgear Engineering Department, General Electric Company, Philadelphia

COMPLETE sequence of starting, speed control and synchronizing of both ends is accomplished automatically for a 6.6-kv., 25/60-cycle, 25,000-kva. synchronous frequency converter recently placed in operation at the Maryland plant of the Bethlehem Steel Company. This was done to relieve the substation operators from the rather exacting synchronizing requirements, and all that is necessary to do in connection with the actual starting and stopping of this set is to operate a single master control switch.

In order to provide power for an expansion at the plant requiring 30,000 kw. demand in excess of the existing combined 25-cycle generated and purchased power capacity of 85,000 kw., it was concluded to purchase this power from the local utility at Baltimore, which was in a position to furnish large quantities from the hydro developments on the Susquehanna River and to obtain it over a new transmission line from the utilities' system to Sparrows Point.

The utility proposed to furnish 60-cycle service because of the commercial and industrial trend with that frequency. If adopted it was important that a tie be made between the two systems. A 25,000-kva., 0.8 power-factor frequency converter was installed and serves three purposes: First, it provides spare capacity for the existing 25-cycle system; second, it provides a means of transferring power generated from waste gases to the customers' 60-cycle load, and, third, it permits the utility to furnish part of the 25-cycle load from its more efficient 60-cycle system. It also was favorable to the Maryland plant to establish 60-cycle service for the new mills because of the many inherent advantages, such as lower cost, greater availability of equipment and larger range of synchronous speeds available for motor drives. Also, the general trend in both the utility and steel industries is to extend the use of 60-cycle power.

An interesting feature of the frequency converter installation was the addition of a 3,500-kw., 600-volt, d.c. generator on the end of the set. The generator supplies power to the No. 2 42-in. tandem cold mill. The combination represents economies in space, foundations, auto-transformers and switching equipment and allows the frequency converter to be started by Ward-Leonard control from the adjacent 3,500-kw. motor-generator on No. 1 tandem cold mill, using the 3,500-kw. generator on the frequency converter as a starting motor. Thus a normally tedious starting job is greatly simplified. Both the 25-cycle and 60-cycle machines are provided with amortisseur windings, so that in an emergency the set can be brought up to speed by connecting the 25-cycle end to a generator in the power house and bringing the set and the generator up together.



25- to 60-cycle frequency-changer set, 28,150-kva., 0.8-pf., 300-r.p.m., 6,600-volt, 60-cycle unit, 25,000-kva., 0.8-pf., 6,600-volt, 25-cycle unit and 3,500-kw., 600-volt d.c. generator (extreme right) for tandem cold-strip mill No. 2. Exciters mounted at left end of set

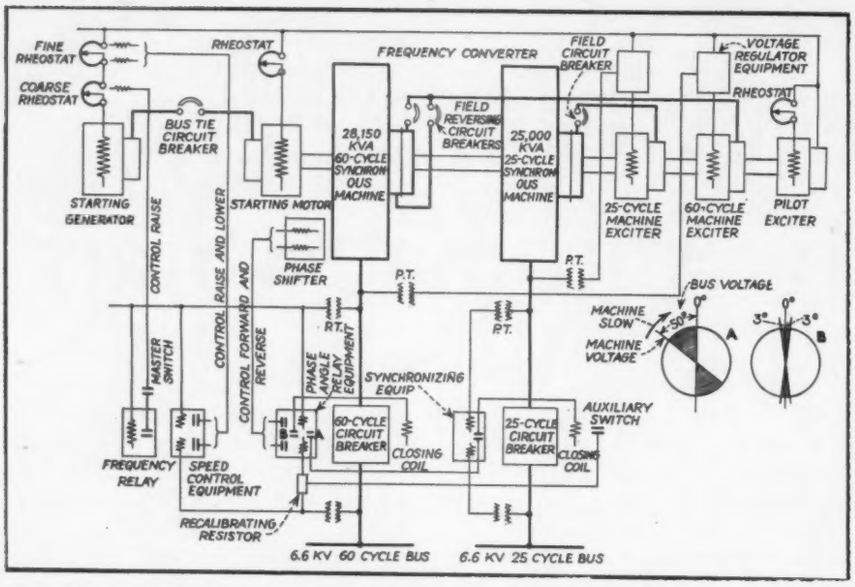


Fig. 1—Automatic starting, speed control and synchronizing of frequency converter in one-line diagram

Functioning is wholly automatic when the attendant closes the master control switch after having changed the d.c. connections to permit using the nearby generator to supply the d.c. generator (used as a starting motor) on the frequency-converter shaft. He also must first run the (motor-driven) phase shifter to shift the 60-cycle frame to the most favorable position for the machine to carry the desired load. Shaded areas in insert "A" show angle range of the 60-cycle phase-angle relays in which initiation of the closing impulse is permitted for the 25-cycle breakers, and shaded areas in "B" show angle range (after recalibration by closing of 25-cycle breaker) to which the phase-angle relays will run the phase shifter and in which the 60-cycle breaker may be closed.

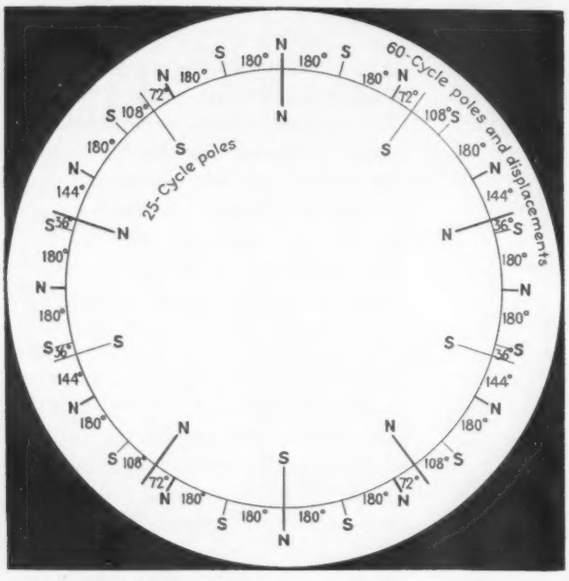


Fig. 2—Pole position diagram of 10/24 pole frequency converter

A pole combination can always be found, no matter how the two machines are shifted with respect to each other, which will show not to exceed plus or minus 18 electrical degrees from synchronism or from phase opposition on the 60-cycle end.

This 6.6-kv., 25/60-cycle, 25,000-kva. synchronous-synchronous frequency converter is provided with the necessary auxiliaries, such as a bearing high-pressure oil system for easier starting, a motor-operated phase shifter for adjusting the phase angle between units, a direct-connected pilot and two main exciters and the previously mentioned d.c. starting motor, which normally functions as a generator supplying power to the mill.

Switching equipment is of the latest shipped-assembled type, consisting of metal-clad gear for the 6.6-kv. circuits, metal-inclosed cubicles for the field and other low-voltage circuits and duplex steel panels for the control switchboard. As previously stated, the unusual feature of this equipment is, however, that the complete sequence of starting, speed control and synchronizing of both ends of this set, operating in parallel with similar units, is accomplished automatically.

Full automatic control

It is believed that this fully automatic speed control and synchronizing of a 25/60-cycle synchronous-synchronous frequency converter, operating in parallel with similar sets, has never been accomplished before, and therefore the brief accompanying discussion of the method (Fig. 1) of accomplishing this is presented in some detail herewith.

The operating schedule of the installation is such that the set is started once per week, as a rule. Although provision is included in the switchgear to permit complete manual control of the individual starting steps, the full automatic starting sequence described is the one that is normally used. It requires seven minutes from the time the starting control switch is thrown until the frequency changer is on the line. Since practically all of this time is consumed in accelerating the set from rest to approximately synchronous speed, the power demand from the a.c. system is kept to the minimum. Also, the set goes on the line with very little disturbance, seldom more than 1,000 kw. swing, which is low for a frequency converter of this rating and represents an important advantage over the much higher starting inrushes which would have resulted from auto-transformer starting.

Sequence of automatic functions

The stator position for this incoming machine at the time it is started is set at the most favorable position for it to carry load after it is paralleled, but it is very unlikely, due to load angle on the other machines, that a pole combination will ever be present which will show a state of exact synchronism on both ends of the set simultaneously. However, it will be seen (Fig. 2) that a pole combination can always be found which will show not to exceed plus or minus 18 electrical degrees from synchronism, or from phase opposition, on the 60-cycle end when the 25-cycle end is in phase.

Thus, it was possible to choose the 25-cycle end of the set as the one to be synchronized first and define reasonably small angular limits on the 60-cycle end, either from synchronism or from phase opposition, in which the 25-cycle end can be paralleled.

Field-reversing equipment is, of course, necessary on the 60-cycle machine in order to remain within the ±18 deg. range previously mentioned. The automatic control of this field-reversing equipment presents no particular problem, because the field excitation may always be applied in the same direction initially, and it need be reversed only once after the closing of the 25-cycle circuit breaker, and then only in case this circuit

breaker is closed with approximate phase opposition on the 60-cycle end.

Field-reversing equipment on the 25-cycle end was not used, although it would have doubled the number of favorable pole combinations available for synchronizing. Its successful use, however, would have required automatic selective operation at frequent intervals during the synchronizing process, with the introduction of time-delay steps between reversals of field excitation, and so did not appear very practical or give promise of saving any time in the process.

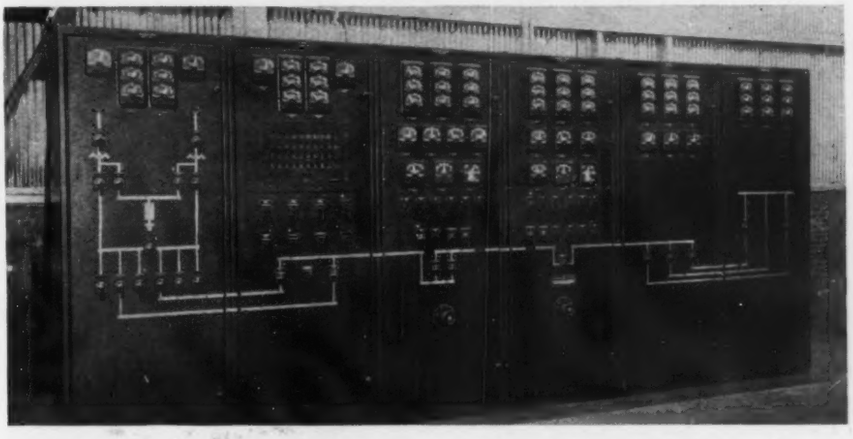
Combination selected automatically

The simplest method of arriving at a proper pole combination acceptable for synchronizing by automatic means was to hold the machine frequency definitely lower (or higher) than that of the bus, so that the machine passes successively through all the pole combinations as they occur, and then to select the proper one as it is reached. The amount of this frequency difference need be just small enough to allow proper operation of the automatic synchronizing equipment, so that the selection of the proper pole position can take place in the minimum time. For this purpose a simple speed control was developed, which measures the time of each slip cycle and controls the fine rheostat in the starting generator field circuit to hold the length of each slip cycle on the 60-cycle end at an average value of four seconds with the machine "slow" and without hunting or overshooting.

The 25-cycle end of the set is provided with a proportional angle of advance synchronizing equipment for closing its circuit breaker, and the 60-cycle end is provided with phase-angle relays to define the phase-angle limits on this end within which the 25-cycle synchronizing equipment is permitted to close its circuit breaker. These angular limits could be in the ± 18 deg. range previously mentioned, and should further be kept at a low value so as not to add materially to the range of stator shift normally required in the design of the machine for load control.

Practically, however, a somewhat larger angle was considered desirable to allow for possible variations in relay settings and also to multiply the number of permissible pole combinations for synchronizing, if possible, to insure more rapid paralleling. In this connection the design of this particular machine permitted a range of stator shift totaling 26 mechanical degrees, of which 19 were required for load angle, thus leaving seven mechanical degrees, or 84 electrical degrees with respect to the 60-cycle unit, for synchronizing purposes. This number of degrees always allows a minimum of two favorable pole combinations in the total of five available from which a selection can be made, and thus one of them can usually be reached within one-half minute during the synchronizing process.

Metal-clad switchgear, for 60-cycle and 25-cycle, 6,600-volt circuits, with 500,000 kva. oil-blast circuit breakers



Duplex switchboard controlling 60-cycle and 25-cycle circuits and 28,150-kva., 25- to 60-cycle frequency-changer set

Since phase-angle relays to permit closing the 25-cycle oil circuit breaker at any angle within the above 84 deg. are not available with a proportional angle of advance feature, it is evident that the entire 84 deg. cannot be taken to give the oil circuit breaker closing impulse. With a circuit breaker closing time of 1/3 second at 0.3 cycle per second slip, which is the maximum slip at which the synchronizing equipment will permit paralleling, it is necessary to allow about 36 deg. for closing the circuit breaker.

Since the speed-control equipment was arranged to hold the machine frequency always below that of the bus, this 36 deg. must be subtracted only from one side of the 84 deg. range, leaving 48 deg. for the angle in which the closing impulse may be given. This angle was actually set at about 50 deg. for this equipment, as shown in "A," Fig. 1. Sequence interlocking is provided in conjunction with the phase-angle relays so that paralleling cannot take place except when the machine frequency is definitely below that of the bus.

Once the 25-cycle machine is paralleled, it is necessary only to bring the voltage of the 60-cycle machine into phase with the bus voltage by means of the stator shifter and then parallel the latter end. The same two phase-angle relays previously used in connection with the synchronizing of the 25-cycle machine were used for this purpose merely by changing the calibration of one of them from —50 deg. to —3 deg. and the other from 0 deg. to +3 deg., and also blocking off the lower shaded area as shown in the change from A to B in Fig. 1. The 60-cycle breaker is thus closed in this ± 3 deg. phase-angle range between machine and bus voltages, thus completing the automatic synchronizing of the set and allowing it to assume the desired amount of load at the direction of the operator or load dispatcher.

PUBLIC RELATIONS SERIES

An Ounce of Prevention

Consolidated of Baltimore Holds Good Public Relations Through "Customer-Minded" Employees

By HERBERT A. WAGNER

President Consolidated Gas, Electric Light & Power Company of Baltimore, Md.

THE American people are becoming more and more critical of business conditions and practices which closely affect them, and particularly of those things the bases of which they know little or nothing about. However, the American people generally are not inclined to be unfair in their judgments of those things and practices about which they are reliably informed. The utilities must do everything possible to gain the confidence of the public they serve.

It is true that many methods have been proposed and tried to create and maintain the most satisfactory customer relations, and after all it is with methods that we are principally concerned.

As to methods, it would seem obvious that they should be as intimate and personal as possible. Neither advertising nor newspaper articles have ever solved the problem. A utility may talk about itself, its accomplishments and its intentions without more than scratching the surface of the problem.

Natural contacts

The first essential is to summarize the means and extent of the natural contacts that a utility has with its customers. To many who have not attacked the problem from this starting point it would be surprising to realize the multitude of ready-made salesmen which a company has in its operating force of employees. From this point of view it should be evident that we would do well to start with the improvement of our relations with our employees, to cause them to be more enthusiastic rooters for the company.

Herbert A. Wagner

Not only do our employees in the course of their work have a far greater number of contacts with our customers than any special sales force that we could well employ, but undoubtedly in their family and friendly relations they collectively meet and talk with a host of people. If a management cannot sell the company and its practices to its own employees, the task otherwise would seem almost hopeless.

Well satisfied and contented employees are really a primary consideration. In fact, the company is represented and known almost solely by its employees and is judged by the acts and attitudes of its employees as well as its managerial policies, service and rates. The humanizing of all the company's relationships and contacts is a most important element in establishing good public relations.

In spite of apparent repetition, I cannot overemphasize the advice to begin with your employees, every one of them. Do all you can to convince them that they represent the company in all their acts and that the company is judged by what they do and say.

Service vs. rates

Good, reliable and continuous service is what the people expect and pay for and is of more moment to them than rates. This refers first to the service that is metered and next to the promptness and adequacy of the attention given to the customer's equipment needs and its servicing. The company's practice in regard to new customers, connection of equipment, servicing, rate structures, the handling of complaints, etc., should be understandable, logical and reasonable not only from the company's point of view but to the customer. A company's past experience with these matters if properly reviewed should disclose those practices which have occasioned disputes with customers.

In order to carry out the humanizing of the company's customer rela-

tions the most effective device is the creation of a separate and special "service department," receiving the active and sympathetic support of the management and staffed by a trained personnel for the sole purpose of handling all customer and public relations, including complaints and inquiries received both at the office and over a central telephone board, investigating and remedying of conditions which interfere with entirely satisfactory service to individual customers, supervising contacts with municipal and state authorities, improvement and community associations, etc.

Anticipation vital

In this connection provision should be made for department heads whose forces perform work in public places or in customers' premises, to meet regularly with the management of the suggested "service department" to discuss practices and policies affecting customers and to learn of complaints and criticisms made as to the company's operations. This should result in a customer-minded attitude on the part of department heads through whom co-operative effort and service may be encouraged in their department personnel.

Service activities should also be extended beyond the home ground of the suggested "service department" and organized with a view to anticipating irritating conditions and to accumulate good will to be drawn upon when needed in the future. All service representatives should learn to talk the language of the man in the street and to seek him out instead of waiting for him to come to the office. They should seek to become a part of the community, instead of just being in the community, and learn to be known as good neighbors instead of being regarded as emissaries of a management which is too busy to be friendly. Many activities may be planned which will bring these representatives closer to customers and thus be able to build friendliness.

It is also effective to have well-informed representatives of the company ready at all times to speak be-

[*Continued on page 98*]

THE FAMOUS "VERNON 0123"—Twenty-four customers' men, officially known as "service representatives," meet the customers who phone Vernon 0123—customer service. The customer tells his story to one of these men, he tells it only once and the entire transaction is handled by this one customer contact

DOWNTOWN CONVENIENCE—Customers calling at this office, conveniently located in the heart of the downtown shopping district, sit at desks, instead of crowding around counters, and discuss service matters privately and unhurriedly

Editorials

S. B. WILLIAMS, Editor

D.C. Transmission Still Experimental

SOME WEEKS ago much interest was aroused by the proposal of J. D. Ross, administrator of the Bonneville project, to couple the Northwest hydro developments to the Eastern power markets by a network of transcontinental lines using high-voltage d.c. transmission. Well-informed engineers were unenthusiastic about the suggestion because they knew that the potentiality was overrated in terms of the actualities of the situation with respect to the feasibility of d.c. transmission.

A meeting of the A.I.E.E. metropolitan section power group last week helped clear the atmosphere by presenting a candid recital of what has been learned from the two years operation of an experimental line. On the strength of the pronouncements at that meeting it can and should be said that d.c. transmission in its present stage of technical evolution is a long way from being "just around the corner" as an economically justifiable tool. While some encouraging technical progress has been effected in establishing a workable setup of rectifying and inverting equipment, the device is not yet an active competitor of a.c. in any situation where transmission can function as an economically justifiable venture.

Granting that more ingenuity of the kind which started with Steinmetz and now is being exemplified by Dr. Willis and his group may override all the small remaining technical impediments, there is still the deterrent that the terminal equipment is complicated, multifarious and expensive in contrast to the simple step-up or -down banks of transformers for a.c. transmission.

Until something far simpler is stumbled upon or, better yet, evolved by methodical research, the overhead transmission line must be very long to permit the conductor and structural savings to compensate for the heavy outlay for terminal equipment. Admittedly these terminal equipment costs can be somewhat reduced if and as they move toward volume production, but it happens in this instance that most of the terminal elements are standardized units which have already reached their level of unit cost.

So the situation is that d.c. transmission is no glamorous magic formula for an immediate nation-wide grid. It may, on the contrary, be another one of those evolutionary potentialities of electrical wizardry that often get applied for quite different purposes than those they are initially conceived by their enthusiastic proponents. Maybe d.c. transmission will prove more feasible for short cable ties than for long open wire lines. Maybe it will prove far better for single-circuit and relatively unimportant lines than as any possible basis for super-power networks.

Maybe it will have to await the now unforseen possibility of generating d.c. directly from fuels without flame combustion. All we know is that it works remarkably well as a practical technical experiment, the costs of which are not announced, but manifestly are such as to warrant considerable moderation in predictions.

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Are Electric Ranges Profitable?

OF ALL the controversial questions currently discussed by the industry, none is more contentious than the question, Are electric ranges profitable?

Of course, the proof of the pudding may be the eating. Only ten years ago fifteen gas ranges were sold to one electric range. Today only four gas ranges are sold to one electric range. The rate of electric range sales has quadrupled in the last ten years.

In some discussions we veer off into a gas versus electric dispute. Or, the discussions rotate around the figures used, and the discussions are endless because costs differ in each company. This, of course, never answers the real question of interest to us, and that is: Are ranges profitable to the utility?

It is a question which should be answered—answered for a utility industry that is becoming sales conscious, for thousands of young customers coming on our lines who are demanding electric ranges and for the people who have invested hundreds of thousands of dollars in manufacturing facilities and depend upon utilities to sell and promote their products.

In an endeavor, therefore, to be of service to all, we have sought the basic data. The problem required a detailed study of all the facts, based upon experiences that were broad and extended over a satisfactory period of time. For more than a year this story has been in preparation. It has been presented in this and a preceding issue of ELECTRICAL WORLD by one of the industry's foremost analysts, located in a company that has been selling 1,000 electric ranges a month.

A procedure by which a company may find its own answer is given, but no categorical answer. In short, says the author, the development of range business need only keep pace, be that pace fast or slow, with the development of other business so that the system load factor is not impaired.

THE electric light and power business from its very beginning has been full of romance. In the past few years, however, the gloom that has pervaded the industry has largely chased away the romance and with it much of enthusiasm and vision. To recapture this inspiration to serve—not for a day, not for a year, but for all time—ELECTRICAL WORLD offers a series of prizes for the best photographs by utility employees which bring out this Romance in the Electric Utility Business.

There is no phase of the business that does not have its Romance—A coalpile with three months supply is what? Just coal? No—insurance of service. Everywhere we have work or equipment that is inspiring.

Not only must the subject have its romantic side, but the picture by its composition must be romantic. And just to make sure that those who look at the photograph see what the camera man saw, each photograph must be accompanied by a romantic title, preferably not more than three or four words that bring out the romantic essence of the picture.

Read the rules of the contest and send in your entries. It is not necessary to be a subscriber to ELECTRICAL WORLD, but every entrant must be employed by an electric light and power company.

SUBJECTS OF PICTURES—Any aspect of the business, power plant to customer premises and all between, may be shown in the pictures entered. The twelve prize-winning pictures and titles will be published in the June 3, 1939, issue of ELECTRICAL WORLD and will be exhibited in New York City at the time of the 1939 convention of the Edison Electric Institute. To avoid repetition in the series, effort will be made by the judges to select prize winners showing different kinds of subjects.

TITLES—Each picture entered is to be accompanied by a title or caption calculated to bring out the significance of the picture, to provoke thought of its meaning in terms of the romance of the industry. This is an important element in the contest. The purpose of the caption is to "point up" the picture, to bring to instant perception its romantic value. For instance, the picture of a lineman working on a pole might be titled with that simple statement. But a more romantic caption would be, "Men + Electricity = Electric Service."

JUDGING AND JUDGES—The twelve prize winners will be selected by three independent judges. One judge will be a photographer of recognized professional and artistic capacity; another will be a publisher or editor (not an ELECTRICAL WORLD man) capable of estimating publication values of entries; the third will be an electric utility executive. Names and connections of judges will be announced later.

RULES

The contest is open to all employees of all electric light and power companies in the United States and in Canada.

Contestants may enter twelve pictures or any lesser number. It is suggested that no contestant enter more than one picture of any one kind of subject.

Each picture is to be accompanied by the negative from which it was made.

All prize-winning photographs and negatives become the property of ELECTRICAL WORLD. In addition to these prize-winning entries, ELECTRICAL WORLD reserves the right to retain any or all photographs and negatives submitted. For each picture, with negative, retained, entrants will receive $1. Those not retained will be returned to entrants on or before July 15, 1939.

Entrants receiving awards, in whose pictures persons appear identifiably, are to secure releases for publication signed by those persons on forms which will be furnished by ELECTRICAL WORLD.

Entries may be either contact prints or enlargements, must be unmounted and may be no smaller than 4 x 6 in. nor larger than 12 x 16 in.

On the back of each picture must be pasted —preferably with rubber cement—a slip of paper on which is typed or written in ink:

1. Name and address of the entrant.
2. Name and address of the company by whom entrant is employed.
3. Entrant's position or occupation in the company.
4. Entrant's title or caption for the picture (Remember—imagination, romance, significance, etc.).
5. Identification and description of the subject in a paragraph of 25 to 50 words. For instance, "Turbogenerator of ——— kw. capacity, —— volts, —— r.p.m., steam at —— lbs., —— deg. F., exhaust to low pressure header at —— lbs., installed ——— in ——— generating station of ——— company.

The contest will close May 1, 1939, and all entries must be in the office of ELECTRICAL WORLD, 330 West 42d St., New York, N. Y., on or before that date.

Winners will be notified as soon as the judges have made decisions.

Better Business Politics

By CARTER FIELD

This noted journalist gives his personal comments and interpretations on current happenings affecting the electrical industry. His background and his location at Washington make his thoughts informative and interesting even though all may not agree with him

WITH the single exception that taxes must get worse before they get better, the prospects so far as probable treatment of business by government are concerned are brighter than at any time since Herbert Hoover was inaugurated.

It's a complicated picture, but boiled down, it is simple. The Roosevelt Administration is positively jittery over the political prospects. On the one hand is the possibility that the Republican party will win the next election, gaining the presidency and the House of Representatives. On the other is the battle of the conservative Democrats to win control of their own convention, which will be held in June of next year, and nominate some one not a New Dealer.

It is these two possibilities which have frightened Roosevelt and his immediate advisers into the policy which gives the promise of peace between Washington and business—even the electric industry—for the period between now and November, 1940.

Fears setback

Still confident of the fundamental correctness of his views, both as to business and as to social reform, the President believes he is facing the danger of a temporary setback, or rather, as he himself puts it, that the New Deal is facing a temporary setback. In fact, in discussing the past Mr. Roosevelt has several times recently given the clue to what he probably would not think of saying outright. He has mentioned the setback which social reform endured when, after eight years of Woodrow Wilson, the country elected Warren Harding president.

Incidentally, that particular setback lasted for twelve years. But there is a lot of talk around Washington, even among Republicans, that the next setback may only last four. This is not based on the Roosevelt line of thought, of course. It merely contemplates coldly the difficulties which will confront any administration that comes into power a year from January, and figures that one term is about all it can expect.

This talk is so general that some one must have picked it up and passed it on to Roosevelt, but it is not calculated to please him. A long-range view is all very well, but the setback just might happen to give historians the notion that the country had rejected Roosevelt and all his works.

Roosevelt's own preference in the long-range view is to have it made so clear, either by his own re-election for a precedent shattering third term, or the clear domination of the next Democratic convention by FDR, with a Roosevelt-picked president succeeding him in the White House, that no historian could possibly avoid the assumption that the second Roosevelt had been a great success.

Some observers began to doubt Mr. Roosevelt's ability to pick his successor when he was losing the purge primaries. But it was the election which first made it doubtful whether the President would be able to force his own renomination in the event that he could not otherwise dictate the nomination. What caused the doubt was the fact that in so many instances the New Dealers won the Democratic primaries, but were thereupon defeated in the election, notably in the tremendously important pivotal state of Ohio, and in Oregon. Whereas in many instances, notably Colorado, Indiana and Iowa, the Republicans apparently would have elected senators had the Democrats Roosevelt wanted purged not been nominated.

Democratic leaders who will control, for the most part, the delegations to the next convention have been talking rather frankly on Capitol Hill. Most of them are far more concerned about having a Democratic president than in any social or economic theory. If the New Deal would keep on providing them with choice seats at the pie counter, fine. If an anti-New Deal candidate would give them a better chance of retaining their seats, fine. For to most of them it's a business, not a crusade.

The lesson

And the unescapable lesson of the primaries and elections of last year is that, other things being equal, a New Deal candidate is weaker than a "Yes, but" Democrat.

Every one concerned, from the President down to the political accidents, has been trying to plumb the depths of the whys and wherefores of this. The answer seems to be clear. It seems to have been disappointment at the failure of the New Deal to make times better, worry about the huge spending without commensurate results, worry about eventual possibilities as to the federal debt, including inflation.

Of course Mr. Roosevelt has always been anxious for business to be better, and has always been desperately opposed to printing press money. But the immediate problem became to encourage business, even at the risk of doing a little violence, temporarily, to his own theories as to what would be best in the long run, so that there would not be these elements of doubt and fear when the country goes to the polls in November, 1940.

So we have the clearing up of the TVA bickering over the purchase price for the Tennessee Electric's properties. We have the sudden agreeable ending for the purchase of the privately owned electric system at Memphis, within ten days. We have the President, on his way South, using a press conference to reassure still further possible investors in the electric industry, to the end that the utilities will begin speedily spending that billion dollars a year.

News OF THE WEEK

Memphis and TVA Agree to Buy Utility's Electric and Gas System

Will pay $17,360,000 for properties of Memphis Power & Light — Company retains generating plant and transmission lines — Legal contract for transfer expected to be completed in near future

Work on drafts of the legal contract for the sale of property of Memphis Power & Light, subsidiary of National Power & Light, to the city of Memphis and the Tennessee Valley Authority is expected to be completed in the near future and actual transfer of the property shortly thereafter.

Last week agreement was reached on the proposed sale whereby the utility would transfer to the city and the TVA all properties of the company excluding the 54,000-kw. steam-generating plant and the transmission lines interconnecting the steam plant with Mississippi Power & Light and Arkansas Power & Light systems, both subsidiaries of Electric Power & Light, another member of the Electric Bond & Share system.

City to pay $15,250,000

The agreement provided that the company will receive $17,360,000 for the electric distribution system and all the gas properties. The city is to pay $15,250,000 and the TVA $2,110,000. On November 30, 1938, the city had agreed to pay $18,127,000 for all the electric and gas properties, including the steam plant, but excluding some minor property and the transmission lines.

It is contemplated that upon settlement of the sales Memphis Power & Light will retire all of the $15,275,000 of outstanding bonds and $6,000,000 of preferred stock. Funds for the retirement of the securities will be made up from the $17,360,000 to be received from the city of Memphis and the TVA plus approximately $4,500,000 of quick assets which the company will retain in the sale. The $8,000,000 of common stock will then have as assets the steam plant and the transmission lines.

It is provided in the agreement that the TVA is to have full use of the generating plant at a cost of $100,000 a year, plus operating expenses, for a period of not less than one year nor more than three years. Thereafter the TVA has call on the plant for a period of fifteen years for 20,000 kw. of firm power and 15,000 kw. of standby. The cost during the fifteen years is to be adjusted on the basis of operating costs.

Will redeem securities

P. B. Sawyer, president of National Power & Light, declared that the understanding reached between the city, the TVA and the company for $17,360,000 and the retaining of net current assets is expected to amount to about $22,000,000 and permits the retirement of the company's bonds at the call price and, it is hoped, the liquidation of the preferred stock at $100 a share.

"The generating plant to be retained will be operated for the purpose of generating and selling power to the TVA and to the Mississippi and Arkansas companies," Mr. Sawyer said.

The sale of the Memphis utility leaves the TVA the entire state of Tennessee as a field for its power operations. The agreement closes a long battle, during which there were many stormy sessions.

Sought system in 1935

Memphis first tried to buy out the utility in 1935, after voting a bond issue of $9,000,000 to buy or build a distribution system for TVA power. With the aid of a $3,092,000 PWA grant the city began to build its own system. So far the city has spent $6,900,000 on the system.

Sale of the Memphis utility follows the recent purchase by the TVA of all the electric facilities of Tennessee Electric Power Co., subsidiary of Commonwealth & Southern Corp.

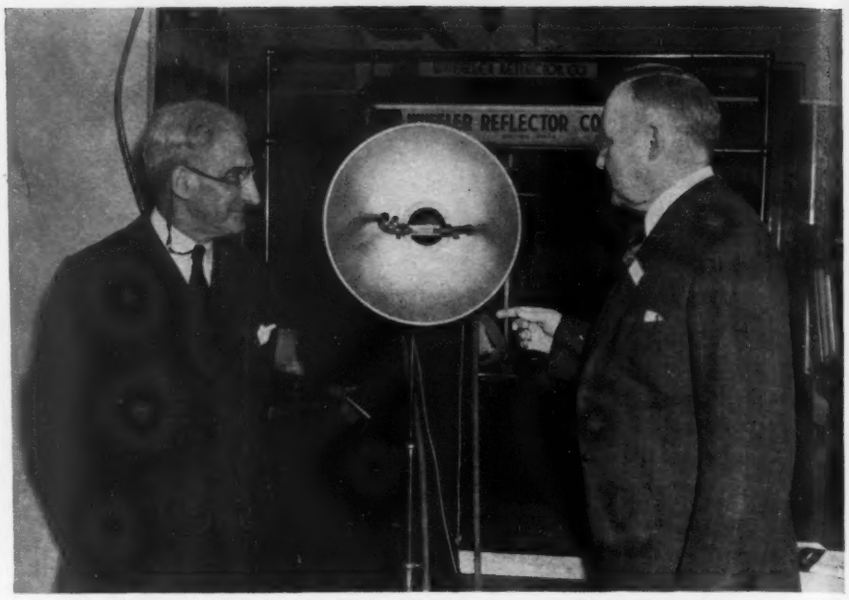
DISHWASHER SINKS—The Modern Kitchen Bureau plans aggressive steps to promote the electric dishwasher sink. L. to r.—R. M. Beatty, Westinghouse; Bruce Fleming, secretary of N.E.M.A.; W. T. Theleen, General Electric; M. H. Beekman, Hotpoint, and S. S. Fisher, Westinghouse, who met recently at Nela Park to discuss plans

G.E. Shows Progress in Lamp Development

Outstanding progress in the development of fixtures and equipment utilizing the newly-developed light sources is revealed at the fixture manufacturers' displays featuring the Lighting Products Show sponsored by General Electric incandescent lamp department. The display was held in the New York G.-E. building.

Designed as an educational trade show, the exhibition, which closed this week, aimed to give lighting artisans and craftsmen a better understanding of the revolutionary new light sources and fixtures for their use that have been developed during recent months. It provided an opportunity to view these new lamps and fixtures.

While the new fluorescent lamps and fixtures formed a center of attraction to visitors, the new mercury-quartz capillary lamp, known as the "Midget Sun," drew considerable interest.



LIGHTING EXHIBIT—Progress in the development of lighting fixtures and equipment is shown at the manufacturers' display sponsored by General Electric. Gerard Swope (left), president of General Electric, with H. B. Myrtle, New York division manager of the incandescent lamp department, view the new "Midget Sun" unit

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Seek to Start Work on Quoddy Project

A move to put into operation the recent recommendations of President Roosevelt to Representative Mansfield, chairman of the House rivers and harbors committee, that consideration be given to place in operation a test power plant at Passamaquoddy, advanced a step further when Senator White of Maine asked that a foundation be laid for appropriations to start work on the project.

While the joint resolution was put over for later consideration by the Senate, it is likely that the Federal Power Commission will be asked to review the tidal power project and its economic possibilities.

On January 3, 1934, the FPC reported that the Quoddy project was unsound and unjustified because it will cost approximately $40,000,000, while a comparable steam-generating plant would cost only $16,000,000; that because the steam-electric plant would be cheaper at the higher load factors Quoddy power could not compete with steam-power rates in export, and that there is no present or prospective market for Quoddy power at any price.

This report of the FPC was followed by one made by engineers of the PWA, who also found that the Quoddy project was not economic. However, these two adverse reports failed to dampen the ardor of the Quoddy advocates, who induced the President to appoint a new review committee which recommended that the Quoddy project should be undertaken. After spending $6,000,000 on the project Congress refused further appropriations in 1936.

The joint resolution now seeks to have the FPC bring its report on Quoddy down to date and have the board of engineers report on the cost and advisability of the project. The resolution seeks to authorize completion of the borings and the investigations and a report to the Congress on the advisability of proceeding further.

It is believed that once the Quoddy advocates obtain a new foothold and obtain funds for an experimental plant Congress can be induced to go through with the entire scheme of harnessing the tides of the Bay of Fundy to develop electric power in a section where a likely market will be difficult to find.

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New Budget Approved After Commission Drops 247

Gov. Arthur H. James has given partial approval to the current and revised budget of the Pennsylvania Public Utility Commission, after his repeated demands for retrenchment has forced the agency to reduce its payroll by 247 officials and employees.

By his action the Governor released to the commmission's personnel pay checks that had been held up for more than a week. He approved the commission's revised budget for January and February, but refused to approve it for the succeeding three months because of his determination to force still further reductions.

New York Utility Unit To Be Ready In June

More efficient use of the water in the Mongaup River will result for Rockland (N.Y.) Light & Power Co. by the construction of the Swinging Bridge No. 2 development of 6,750 kw. The new hydro-electric development will be a few hundred feet below No. 1 station of 5,000 kw.

The Cliff Lake reservoir level is being raised 23 feet, and new tunnel work will permit delivery of water into Swinging Bridge reservoir and utilization in hydro units below the latter's dam. Work on the new project is scheduled to be completed in June.

Remote control of both plants will be used from Mongaup plant below, with energy transfer to system by 33-kv. tie line already in service.

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Rural Customers Get Refund

The Black Earth municipal electric utility, under an authorization of the Wisconsin Public Service Commission, will refund about $8,000 paid by rural customers for extension of lines to their farms. Under the old rate schedule the customers paid the cost and upkeep of their lines, while under the new rates, which are similar to those being applied in the neighboring territory by Wisconsin Power & Light Co., customers will pay $1,100 a year increase in rates, but the company will meet upkeep costs.

Supreme Court Asked to Accept Doctrine of Prudent Investment

Pennsylvania commission joined by Roosevelt Administration and New York commission in fight against Edison Light & Power — Present case seen as highly important to utilities in rate-making

Advocates of prudent investment as the basis of public utility valuation for rate-making purposes gained considerable headway last week as the Supreme Court took under consideration the case of Edison Light & Power Co. of York, Pa.

The proposed system, first enunciated by Justice Louis D. Brandeis and long advocated by President Roosevelt, would mean a departure from the system in vogue for forty years, under which reproduction cost must be considered in arriving at fair values.

Used for rate cuts

Receiving new support, since President Roosevelt started his drive against the utilities and his federal power program, the prudent investment theory has come to be looked upon by many state utility commissions as a method of making temporary rate reductions in recent years.

Outcome of the case before the court has gained wide interest in utility circles. It is believed that should the court uphold the prudent investment doctrine it would upset all utility valuation and start a new wave of rate litigation.

The present case is the culmination of proceedings begun in January, 1936, when the Pennsylvania commission first issued a temporary rate order affecting the York utility. The case represents the first test of a temporary rate law of this character in the Supreme Court.

Under the utility legislation sponsored by former Governor Earle, the commission was empowered to set temporary rates pending determination of final rates. In 1937 the Pennsylvania commission issued a second temporary rate order, reducing rates $435,000 annually, as in the first, after meeting objections raised by the Edison company. This order was attacked in a three-judge District Court, which, by a two-to-one vote, upheld constitutionality of the law, but enjoined the order itself as confiscatory. The utility carried the case to another statutory district court, which reversed the earlier ruling and handed down an injunction restraining the commission on constitutional grounds.

The injunction was made permanent by the statutory court in Philadelphia in October, 1938. It was on this order that the Pennsylvania commission appealed to the Supreme Court.

In the present case the Supreme Court was asked to discard former methods of utility valuation and set the prudent investment theory as the procedure in rate making. The Pennsylvania commission was joined by the Roosevelt Administration when Solicitor-General Robert H. Jackson filed a brief as a "friend of the court." The New York commission filed a brief with the court attacking a decision of the Pennsylvania federal court in declaring unconstitutional the law authorizing the commission to make temporary rate reductions.

Mr. Jackson had argued before the court that the present "rule of fair value," which must consider reproduction costs, has resulted in a breakdown of the process of rate regulation. He declared that the "rule of prudent investment, combining as it does exactness, ease of application and a proper principle for the determination of just compensation, is the standard for rate making best adapted to modern business conditions and practice in this country."

Former Pennsylvania Attorney-General Guy K. Bard, appearing, at his own request, as counsel for the commission, told the court that the reproduction cost doctrine is "unsound and unworkable." He said that the advantages of prudent investment were "twofold"; it would avoid the hopelessly prolonged and expensive controversies arising from the present procedure which requires periodic reappraisals, and it would greatly reduce the speculative character of public utility investments.

Court upholds New York

The New York commission argued that the Pennsylvania law is very similar to the New York law which has been upheld by the Court of Appeals.

It was the company's contention that the law, which fixed temporary rates to yield a return of not less than 5 per cent of original cost less depreciation, was unconstitutional, for it did not take into consideration other factors in determining value of utility property.

Chief Justice Hughes, in questioning during arguments, explained that the issue before the court was not whether the commission had erred in arriving at its valuation of $5,250,000 for the company's property, but whether the return allowed was "confiscatory."

The company argued that it was entitled to a return of 7.5 per cent on its property.

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Government, Utilities at Peace—Roosevelt

President Roosevelt declared last week at a press conference, as he departed for the Navy war games in the Caribbean, that the Administration and the private utilities were at peace. He declared that for the last year and a half 95 per cent of the utility executives were aware of the fact that the government would not extend its power development program. Mr. Roosevelt expressed hope that the utilities would proceed with their contemplated expansion programs.

Reaction to the President's statement was complete surprise in some quarters. Wendell L. Willkie, president of Commonwealth & Southern Corp., stated that the President's statement should be definitely "put into writing." Mr. Willkie pointed out that he expected to take up negotiations with the TVA with reference to the sale of certain properties of Mississippi Power and Alabama Power to the TVA and that the "limiting of TVA territory" should be written in the agreement.

"The assurances of the President to the limiting of TVA operations are very helpful," Mr. Willkie said, "but, if such assurances are definitely embodied in the agreement of sale, absolute guaranty can be given to the investors. Such a provision in this agreement would be exceedingly helpful to the utilities and to business recovery."

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Commonwealth Edison Takes Over Powerton Station

Super-Power Co. of Illinois, which built and operated the Powerton station at Pekin, Ill., and was jointly controlled by Commonwealth Edison Co. and Public Service Co. of Northern Illinois, was liquidated as of December 31, according to an announcement from the office of James Simpson, chairman of the two controlling companies.

The station, transmission lines and other plant of Super-Power are taken over by Commonwealth Edison and will be operated with the present staff and organization as a department of the Chicago company, R. H. James, formerly president of Super-Power, remaining in charge.

State Board Ousted; Enjoinder Issued

Governor Fitzgerald of Michigan signed last week the bill passed by the Legislature abolishing the state Public Utilities Commission and establishing a Michigan Public Service Commission to replace it. He immediately appointed John J. O'Hara of Menominee, formerly auditor-general, as chairman of the new commission for a term of three years. The other appointees are: Gilbert T. Shilson, East Lansing, for a term of five years; Ivan E. Hull, Grand Rapids, four years; Don McIntyre, Jackson, two years; Miss Florence M. Kiely, Saginaw, one year.

The principal difference between the new commission and the old is that the new commissioners would serve staggered terms. It is specifically given jurisdiction over some new utilities and some motor carriers about which there has been doubt in the past. Commissioners will be paid $6,000 a year instead of $7,000. The terms of the members of the ousted commission would have expired in June. Minor employees of the old commission will be transferred to the new body.

A temporary injunction delayed Governor Fitzgerald's shake-up of the commission. The enjoinder was issued by Circuit Judge Leland W. Carr of Ingham County, on petition of Chairman Paul H. Todd and Commissioner Joseph M. Donnelly of the expiring body.

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Sponsors Adequate Wiring

At the recent meeting of the Electrical League of Richmond, Va., officers for the year were elected and the 1939 program adopted. The league will intensify its activities in adequate wiring. Educational work will be carried out among electrical contractors, architects and builders. Boyd A. Propert, district manager of General Electric Supply Co., was elected president to succeed Edgar M. Andrews.

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Builds Connection with TVA

Florence, Ala., has begun the construction of a transmission line from city limits to a connection with high-tension system of TVA. The new line will cross the Tennessee River and will connect with a power substation in the municipality. Service will be secured from this source for the municipal light and power system. Contract for line construction was recently awarded to M. R. Thomason, Montgomery, Ala., at $22,570.

NEW OFFICERS—At a recent meeting of the Electrical League of Richmond, Va., the following officers were elected: L. to r.—J. S. Hamilton, agricultural engineer of Virginia Electric & Power, secretary; E. T. Magruder, plant superintendent, Chesapeake & Potomac Telephone Co., vice-president; Edgar M. Andrews, electrical contractor, retiring president; Boyd A. Propert, district manager of General Electric Supply Co., president and C. V. Pemberton, electrical contractor, treasurer

Report on War Power Ready in Two Months

Report of the National Power Policy Committee showing the need for additional generating capacity to meet war-time emergency of industry is expected to be ready within the next two months and sent to President Roosevelt.

Assistant Secretary of War Louis A. Johnson, chairman of the committee, stated that reports from engineers in the different industrial centers are being studied so that a comprehensive picture can be gained for the country as a whole.

Reports from industrial concerns, which will be called upon to supply war materials, showing their power requirements are being received and discussed by the committee. It is expected that these reports will prove highly valuable to government officials as well as utilities which will be called upon to meet a greatly expanded power load in case of an emergency. Many situations are being brought to light which had heretofore been unknown.

Because of the magnitude of the problem confronting the committee, which President Roosevelt appointed last September, Mr. Johnson said that every precaution is being taken to insure an accurate and comprehensive report. The power requirements, as well as present deficiency in installed capacity, will be shown in the report. Requirements by industries are also expected to be shown. A highly interesting feature of the report will be the map showing recommended interconnections between utility companies, so that in case power plants or lines are destroyed in one area the utilities in adjoining areas can supply power to the stricken communities.

It is anticipated that the recommendations of the committee will be of such a nature as not to work a hardship on the utilities. It is expected that the recommended interconnections, to provide emergency power, will also serve to strengthen present networks and can be included as part of the rate base. Inclusion of such properties would eliminate objections voiced that the utilities would be called upon to make capital expenditures on which no return could be expected.

Mr. Johnson said that the utility companies were co-operating with the committee in its work and have placed orders for additional generating capacity. Last fall fourteen major companies made commitments for 1,000,000 kw. of additional capacity.

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Seek Uniform Tax System

An executive committee consisting of W. E. Owen, Downing; Vern G. Howard, Granton; H. O. Melby, Westby; John E. Olson, Chetek, and W. E. Rabe, Oakdale, has been named to secure a uniform method of taxation for all electric co-operatives in Wisconsin. The committee was named as the result of a conference called by the Wisconsin Development Authority at the suggestion of presidents and attorneys of Wisconsin electric co-operatives.

First Edison Unit at Boulder Dam to Be Placed in Service in July

Southern California Edison to increase capacity by 82,500 kw. upon completion of installation — Sales of appliances expected to increase new revenue of system by $4,461,650 — Plans line work

Southern California Edison Co., Ltd., expects to add $4,461,650 of new revenue to the system this year through sales of appliances and increased customer use of electricity.

Construction activities this year call for a budget of $7,500,000, as against one of approximately $9,000,000 in 1938. Last year the budget included the 233 miles of 220-kv. steel tower transmission line from Boulder Dam to Chino, Calif. During the year the company added approximately 130 miles of distribution lines to the system, bringing the total lines in service to 14,050.

New Boulder unit

Generating capacity of the system will be increased 82,500 kw. when the first Edison unit at Boulder is brought into service next July. The second 82,500-kw. unit in the same power house probably will be ready for service at the end of 1939 or early in 1940. The Boulder units are not included in the utility's budget as they are being installed by the government and leased to the company.

The 1939 budget calls for expenditures of $4,357,552 for distribution lines, $1,029,907 for substation, $603,259 for transmission lines, $626,473 for hydraulic generation plants and $275,807 for steam-generating plants.

The company stated that its service to farms and the rural territory is so widespread that it is unnecessary to have a specific rural electrification program. However, business comes from increased use among existing customers or the further development of land already within reach of the lines. The commercial department anticipates additional agricultural revenue in 1939 of $281,000, of which $200,000 will come from power for irrigation and the remainder from miscellaneous uses.

Appliance sales

Retail value of electrical appliances sold in the company's territory last year is estimated at $10,000,000 and the program for 1939 forecasts a total of $11,000,000. The company estimates that dealer sales, supplemented by certain company promotion efforts, will result in the marketing in 1939 of 5,000 ranges, 2,400 water heaters, 30,000 refrigerators, 50,000 radios, 20,000 washers, 3,000 ironers and 375 kw. of air conditioning. Total estimated annual revenue from new appliances is $1,391,650 and estimated new revenue from all other sources $3,070,000.

Domestic kilowatt-hour consumption in 1928 was 560; in 1937 it was 910 and in 1938 it reached 948. Indications are that it will be close to 1,000 kw.-hr. at the end of this year.

TVA Appropriation Approved by Senate

The Senate overrode the economy bloc last Tuesday by voting 49 to 31 approving the $4,500,000 appropriation for beginning the Watts Bar Dam by the TVA. Immediately afterward, without a record vote, the Senate accepted the appropriation of $12,500,000 for continuation of work on the Gilbertsville Dam. Both items must be reconsidered by the House, which had previously eliminated them, before the bill goes to the White House for approval.

The Senate appropriations committee last week put back the $17,206,000 for TVA in the independent offices appropriation bill which the House had previously rejected.

Delay in Hearing Asked by Niagara Falls Utility

Stating that Paul A. Schoellkopf, president of the company, is at present on a trip around the world, and that Norman R. Gibson, vice-president and chief engineer, has arranged to leave March 11 for a "much-needed and long-deferred vacation," the Niagara Falls Power Co. has petitioned the FPC for a continuance of the hearing set for March 15 on its rights to divert water at Niagara Falls for power purposes.

The petition states that the extent of its rights to divert waters of the Niagara River for power purposes under grants and acts of the New York Legislature is now at issue in a litigated action between the company and the Water Power and Control Commission. "Until a decision has been rendered by the Supreme Court of the State of New York in said litigation," the petition contends, "petitioner believes that no good purpose would be served by a further hearing in this proceeding which would relate to or involve the same subject matter."

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California Utilities Aided by Snowfall

Key to the potential performance of California's 1,693,000 kw. of installed hydro capacity is the cooperative snow survey issued periodically during storm seasons. Water reserves are a function of accumulated snow pack plus seasonal precipitation.

Although the year began with on-the-ground snow representing but half the water content of the pack a year ago, storms during late January and early February considerably improved the situation.

Latest reports, based on measurements taken in lulls during the storm, indicate the snow pack has almost doubled and now approaches normal expectancy for this time of year. Precipitation, however, is still far below normal in all Sierra watersheds. Areas drained by the state's northern rivers are at 50 to 60 per cent normal, the situation improving to 65 to 85 per cent normal as readings proceed south.

South of the Tehachapi Range, the Santa Ana, San Gabriel and Los Angeles Basins run 100 to 115 per cent normal.

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Wins Black Sales Trophy

I. B. Adams and the San Jose division of Pacific Gas & Electric Co. were 1938 winners of the James B. Black Perpetual Sales Trophy awarded annually for the outstanding sales record. Mr. Adams is San Jose division manager. Shasta division, G. R. Milford, manager, was second; East Bay division, L. H. Newbert, manager, third.

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W.P.I. Construction Plan

Worcester (Mass.) Polytechnic Institute board of trustees has authorized a million-dollar program of building construction and campus development. The Memorial building will be erected first. Bids will be called for this spring, and it is planned to have ground broken and work under way by commencement. It should be completed by June, 1940, and the whole construction program by the opening of the 1942 fall term.

Iron and Steel Men to Meet in Alabama

Official program for the annual spring conference of the Association of Iron and Steel Engineers, which will be held in Birmingham, Ala., March 27 and 28, has been announced by Fred M. Sturgess, chairman of the Birmingham section of the association.

At the technical sessions on Monday, March 27, H. A. Travers, power system engineer, Westinghouse, will present a paper on "Relay Protective Methods for Steel Mill Service." "Modern Wire Drawing Practice" will be discussed by J. J. Phifer, Tennessee Coal, Iron & Railroad Co., Birmingham, and William Mandy, Texas Co., Birmingham, will discuss "General Types of Lubricants Essential to the Steel Plant." George Ramsey, Tennessee Coal, Iron & Railroad Co., will talk on "Unique Features in Southern Blast Furnace Practice."

As customary, inspection trips will be conducted to plants in the area of this national meeting.

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Maryland Utility Group to Hold Annual Meeting

Announcement has been made that the Maryland Utilities Association will hold its annual spring meeting at the Lord Baltimore Hotel, Baltimore, Md., on Friday, April 14.

Three meetings will be held in the morning, one each for the electric, gas and transportation groups. Officials from utility organizations will speak at each of these meetings. A luncheon will be served after the morning meetings, followed by a combined meeting of the three groups.

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Private Utilities Buy 88% of Turbo-Generator Units

Private utilities still account for about 88 per cent of all the turbine-generators bought in this country, and most of them purchased during the past year were of the new hydrogen-cooled type, according to a survey of large unit purchases made by W. E. Blowney, turbine engineer for General Electric Co.

The study of Mr. Blowney was based on his company's sales of turbine-generators rated 10,000 kw. and above, exclusive of those for marine propulsion, during the two four-year periods 1926–29 and 1935–38.

The survey revealed that industries and municipalities bought an increased percentage of turbines in the 1935–38 period over purchases in the years 1926 through 1929, but that their share represented only a small part of the total volume. Private utilities remained the big buyers and accounted for all but 12 per cent of the business.

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$75,000 for TVA Legal Fee

The Tennessee Valley Authority paid $75,000 to John Lord O'Brian, New York attorney and unsuccessful Republican candidate for Senator, for legal services in the Ashwander and Tennessee Electric Power Company cases against the agency, the House appropriations committee revealed this week.

Meetings

Pennsylvania Electric Association—Operations section, Benjamin Franklin Hotel, Philadelphia, Pa., March 1–2. J. M. Orr, general manager, Equitable Auto Co., Pittsburgh, Pa.

American Society for Testing Materials—Regional meeting, Deshler-Wallick Hotel, Columbus, Ohio, March 8. Committee Week, Deshler-Wallick Hotel, March 6–10. R. E. Hess, assistant secretary, 260 South Broad St., Philadelphia, Pa.

Northwest Electric Light and Power Association—Business development section, Portland, Ore., March 16–18; engineering and operation section, Seattle, Wash., April 19–22; accounting and business practice section, Vancouver, B. C., May 26–27. Berkeley Snow, secretary, 707 Spalding Bldg., Portland, Ore.

Edison Electric Institute—Sales committee, Edgewater Beach Hotel, Chicago, Ill., March 20–24. Bernard F. Weadock, managing director, 420 Lexington Ave., New York, N. Y.

Oklahoma Utilities Association — Annual convention, Tulsa, Okla., March 20–21. Kate A. Niblack, secretary, 625-626 Biltmore Hotel, Oklahoma City, Okla.

Association of Iron and Steel Engineers—Spring conference, Tutwiler Hotel, Birmingham, Ala., March 27–28. Brent Wiley, managing director, Empire Building, Pittsburgh, Pa.

Southeastern Electric Exchange — Annual conference, Ponce de Leon Hotel, St. Augustine, Fla., March 30–April 1. J. W. Tally, executive secretary, 308 Haas-Howell Bldg., Atlanta, Ga.

Midwest Power Conference—Palmer House, Chicago, Ill., April 5–7. L. E. Grinter, dean Armour Institute of Technology, Chicago, Ill.

Missouri Valley Electric Association — Engineering conference, President Hotel, Kansas City, Mo., April 6–7. I. D. Pettegrew, acting director, 1527 Sharp Bldg., Lincoln, Neb.

Missouri Association of Public Utilities—Annual convention, Muehlebach Hotel, Kansas City, Mo., April 12–14. Jesse Blythe, assistant secretary, Merchants Bank Bldg., 101 West High St., Jefferson City, Mo.

Maryland Utilities Association — Spring meeting, Lord Baltimore Hotel, Baltimore, Md., April 14. Warren D. Haley, secretary, 16 Carroll Av., Takoma Park, Md.

Electrochemical Society—Spring convention, Columbus, Ohio, April 26–29. Dr. Colin G. Fink, secretary, Columbia University, N. Y.

FCC Opens Two New Channels for Utilities

Two new radio frequencies have been opened to public utilities for special emergency services as a result of hearings before the Federal Communications Commission on the request of Southern California Edison Co. These two frequencies are in addition to the 2726 kc. for special emergency groups in general.

On the basis of testimony before the FCC, it was found that the 2,726 kc. frequency is subject to considerable limitation when used during the day and does not provide reliable service over the entire system of Southern California Edison. The utility showed that emergencies which disrupt power facilities and telephone lines similarly affect all emergency organizations with which the special emergency frequencies are shared.

The commission found that at times when the utility's dependence on radio is at a maximum the frequencies are subject to the greatest congestion. On this basis the present frequencies were considered inadequate from a technical and traffic standpoint to provide reliable emergency communication throughout its area of operation.

In granting the request of Southern California Edison the FCC opened to all utilities frequencies of 2,292 and 4,637.5 kc. These two frequencies are for the exclusive use of all utilities. The FCC provided these two frequencies for fixed, land and portable-mobile stations with a maximum power of 50 watts and are in addition to the present 2292 kc.

According to information the following companies are either operating special emergency radio stations or have made applications for licenses for stations under the rules:

Detroit Edison, Houston Lighting & Power, Indiana & Michigan Electric, Kansas Gas & Electric, Northwestern Electric, Ohio Public Service, Pennsylvania Water & Power, Pennsylvania Power & Light, Philadelphia Electric, Puget Sound Power & Light, Southern California Edison, Southern Colorado Power, Southern Sierras Power, Louisville Gas & Electric, Florida Power & Light and Turlock Irrigation District.

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Asks TVA Taxes for Cities

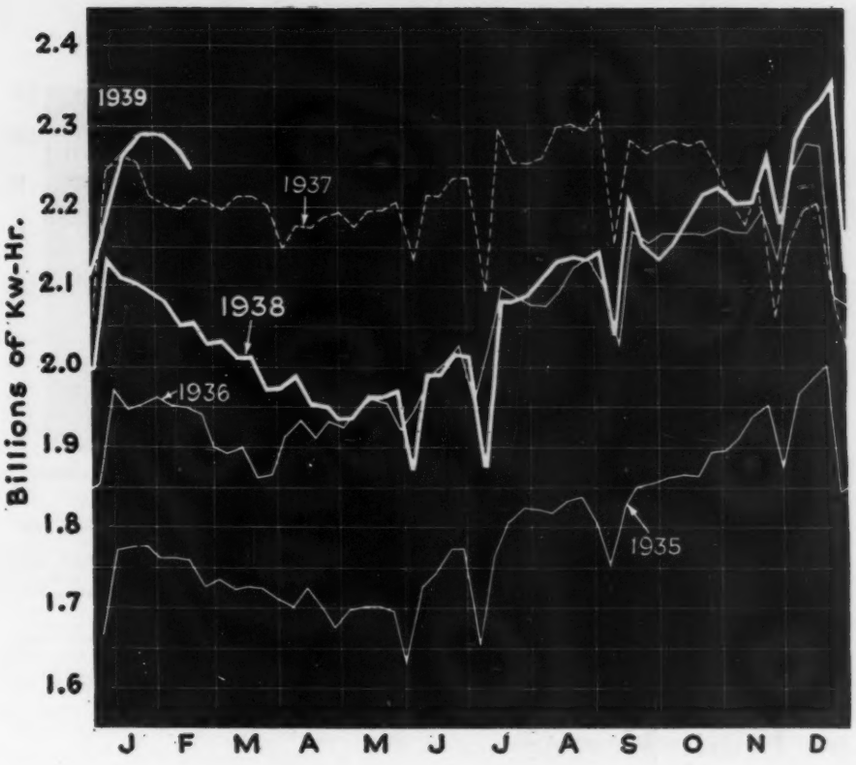
Rep. Frank B. Whelchel of Georgia introduced in Congress last week a bill authorizing the Tennessee Valley Authority to reimburse counties and cities for taxes lost through the purchase, by TVA, of properties of the Tennessee Electric Power Co.

Output Dips 0.8% in Week; 9% Above '38

Production of electric energy by the electric light and power industry for the week ended February 18 totaled 2,248,767,000 kw.-hr., an increase of 9.2 per cent over the corresponding week of last year, according to the Edison Electric Institute.

While the output dropped somewhat below the figure for the previous week (about 0.8 per cent), it remained above the corresponding week for 1937, the margin being about 1.7 per cent. The slight decline from the week ended February 11, as contrasted with equally minor gains in corresponding periods in earlier years, was probably attributable to differences in weather conditions.

New England, with a gain of 14.4 per cent over the previous year, remains in the lead of the geographic regions, with the Central Industrial section second, with 11.1 per cent. The Rocky Mountain region moved into third place, with a gain over the previous year of 9.8 per cent, doubtless reflecting increased power consumption by the mining industry.



Weekly Output, Millions Kw.-Hr.

1939	1938	1937
Feb. 18..2,249	Feb. 19..2,059	Feb. 20..2,212
Feb. 11..2,268	Feb. 12..2,052	Feb. 13..2,200
Feb. 4..2,287	Feb. 5..2,082	Feb. 6..2,201
Jan. 28..2,293	Jan. 29..2,099	Jan. 30..2,215
Jan. 21..2,290	Jan. 22..2,109	Jan. 23..2,257
Jan. 14..2,270	Jan. 15..2,115	Jan. 16..2,264

Per Cent Change from Previous Year

Region	Week Ending Feb. 18	Feb. 11	Feb. 4
New England	+14.4	+16.3	+17.2
Middle Atlantic	+ 8.0	+10.1	+10.1
Central Industrial	+11.1	+12.7	+11.9
West Central	+ 1.4	+ 1.4	+ 0.9
Southern States	+ 6.8	+ 7.7	+ 6.7
Rocky Mountain	+ 9.1	+ 9.8	+ 1.8
Pacific	+ 3.6	+ 7.4	+ 7.5
United States	+ 9.2	+10.5	+ 9.8

Western States Aim to Cut Rates in Pact

Revision of the Colorado River Compact and the Boulder Canyon Project Act, aimed at clearing up certain financial aspects which will permit lower power rates from Boulder Dam, is provided in an agreement reached by representatives of the seven Colorado River Basin states after a series of conferences at Phoenix. The program culminates efforts initiated almost two years ago by the Los Angeles Bureau of Power and Light and the Metropolitan Water District to secure a reduction in power charges.

The preliminary pact is to be officially ratified at a later meeting in Denver and then will be submitted to the seven state legislatures and to Congress. Its terms include:

1. Provision of an annual fund of $500,000 by the power contractors (Bureau of Power and Light, Southern California Edison Co., Metropolitan Water District and Nevada-California Electric Corp.) beginning in 1940, proceeds of which will be devoted for the first three years to a comprehensive survey of the Colorado River Basin. Thereafter annually for twelve years the $500,000 will be allocated to upper basin states to develop their respective projects on the river.

2. Provision for annual payments of $300,000 each to Arizona and Nevada commencing in 1940 and extending for a period of 47 years.

3. Reduction of the interest rate from 4 to 3½ per cent or less on the $130,000,000 construction cost of Boulder Dam.

4. Abolition of all interest on the $25,000,000 allocated to flood control and the deferment of repayment of this item until the other project costs are amortized.

5. Resultant reduction of the present power cost of 1.63 mills per kw.-hr. for falling water to approximately 1 mill.

Numerous conferences have been held heretofore in an effort to arrive at a satisfactory compromise with the power contractors, but they have usually ended in open rupture between the various state interests.

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Bonneville Gets Property

Title to 119 pieces of property in Skamania and Clarke counties, Washington, has passed into government hands, as the Bonneville administration continued to acquire property for transmission lines. Involved was about $56,000. Condemnation proceedings took place in the U. S. District Court at Tacoma, Wash., with Johnston Wilson of Portland acting as attorney for the project.

Venezuela Utility Marks Its 50th Anniversary

Venezuela Power Co., Ltd., Maracaibo, Venezuela, South America, recently celebrated its 50th anniversary, having been established seven years after the installation of the Edison Pearl Street station in New York, 1881, the first in America.

The Venezuela utility has changed hands several times since it was formed October 24, 1888. Until 1926 it was the Maracaibo Electric Light Co., when its name was changed to that at present when it became a subsidiary of International Power Co., Ltd., Montreal.

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Will Issue Service Reports

A proceeding brought on complaint of consumers of the New York State Electric & Gas Corp. regarding the quality of electric service provided in the Harlem Valley division of the company in Dutchess, Putnam and Westchester counties has been discontinued by the Public Service Commission, which has ordered the corporation to submit monthly reports setting forth progress made in carrying out improvements in its service and facilities.

Stocks Up in Week; Bonds Steady

50 Bonds
PRICE TRENDS OF ELECTRIC UTILITY SECURITIES
36 Common Stocks
36 Common Stocks
50 Bonds
85 80 75 70 65 60 55 50 45 40 35 30 25 20 15 10
110 100 90 80
1931 1932 1933 1934 1935 1936 1937 1938 Jan. Feb. Mar. Apr. May June 1939

Electric power and light stocks gained during the week, with the 'Electrical World" index up 0.3 point to 30.8, a new high for the year to date; index a year ago, 25.7. Bonds were steady during the week, with the index at the previous week's mark, 104.7

Reopen Proceedings on Utility Merger

FPC has announced its order setting hearing on April 3 on the joint application of the Metropolitan Edison Co. and the Northern Pennsylvania Power Co. for approval of the merger of the latter company with the former.

Conditional approval of the merger was granted by the commission by an order adopted November 20, 1936, but this is now suspended because, according to the commission, the decision of the Superior Court of Pennsylvania on July 15, 1938, clearly indicates that the terms and conditions upon which the applicant companies are seeking approval of the sale are materially different from the terms and conditions submitted to the Federal Power Commission at the time of the granting of its prior conditional approval and as subsequently modified.

The original application was the first received by the commission under Section 203 of the Federal Power Act and was filed three days after the act was signed by the President.

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North American Stock Taken

Preferred-stock holders of North American Edison Co. have subscribed for approximately 69 per cent of an issue of 696,580 shares of preferred stock, 5¾ per cent series, of the North American Co., offered recently.

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Permit Saguenay Refunding

Application of Saguenay Electric Co., subsidiary of Saguenay Power Co., for permission to refund on April 1 the outstanding 5½ per cent first mortgage issue of $1,122,000 at 102 and to issue instead $1,250,000 of 4½ bonds, with a thirty-year maturity, has been approved by the Quebec Electricity Board. About 75 per cent of the outstanding bonds are held in the United States.

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Utility Offers to Revamp Accounting on Service Fees

New York State Electric & Gas Corp. has offered to revamp its accounting set-up on charges paid to so-called "service" companies between 1932 and 1934, crux of the New York Public Service Commission's investigation into the company's bookkeeping methods. The offer came at a resumption of hearings in an inquiry centering on the commission's assertion that approximately $7,000,000 of such disbursements violated an order of the commission made in 1932 requiring that they be charged to surplus.

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Calls Bonds for April 1

New York Curb Exchange has announced that $2,450,000 of Illinois Power & Light Corp. first and refunding 6 per cent series A bonds of 1953 has been drawn for redemption on April 1 at 105.

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Approve Power Bonds

Voters of Monroeville, Ohio, at the election last week approved a $42,820 bond issue for the erection of a municipal electric power plant by a vote of 389 to 119. A PWA grant also is to be obtained.

Texas Utility Files $6,600,000 Issue

Community Public Service Co., Fort Worth, Tex., has filed a registration statement with the SEC covering $6,600,000 of first mortgage 4 per cent bonds, due 1964. Proceeds, together with other funds, will be used for the redemption on or before June 1, 1939, of $6,659,000 of the company's outstanding first mortgage twenty-five year 5 per cent sinking fund bonds, series A, to be redeemed at par and accrued interest.

At a hearing before the SEC Everett H. Maxcy, vice-president and secretary of the Central Maine Power Co., said the proposed issue of $4,500,000 of first mortgage series J 3½ per cent bonds would be offered at 102 and that the proposed offering date of the securities was February 24. Proceeds will be used to retire $3,303,000 of 5 per cent first mortgage bonds due in November and to pay off $1,000,000 of bank loans. An offering of 5,000 common shares at 100 will be made by the company to holders of common and 6 per cent preferred. New England Public Service Co., parent, is expected to buy any of the shares which stockholders do not take.

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Vote Municipal Plant

Voters of North Baltimore, Ohio, approved at an election last week by a vote of 675 to 618 the proposed $221,000 municipal electric power plant. Service is now being provided by the Central Ohio Light & Power Co. The PWA has approved a grant of $87,000 for the new municipal plant.

Utility Reports (Earnings)

	Net Income 1939	1938
†Detroit Edison and subs.	$8,218,673	$9,426,324
	1938	1937
*American G.&E. and subs.	12,130,316	13,648,222
*California Oregon Pwr.	896,114	927,735
*Columbia G.&E. and subs.	3,611,253	4,189,331
*Erie Lighting	173,042	224,153
*Florida Power	442,613	356,603
*Kansas City Pwr. & Lt.	3,806,729	4,360,143
*Louisville G.&E. (Del.) and subs.	1,197,006	1,178,452
*Oklahoma G.&E.	2,344,748	2,580,425
*Pennsylvania Elec. and subs.	1,817,963	1,685,779
*San Diego Cons. G.&E.	1,470,554	1,331,867
*Southern Calif. Edison	11,733,479	12,136,162
*Southern Colorado Pwr.	218,857	228,018

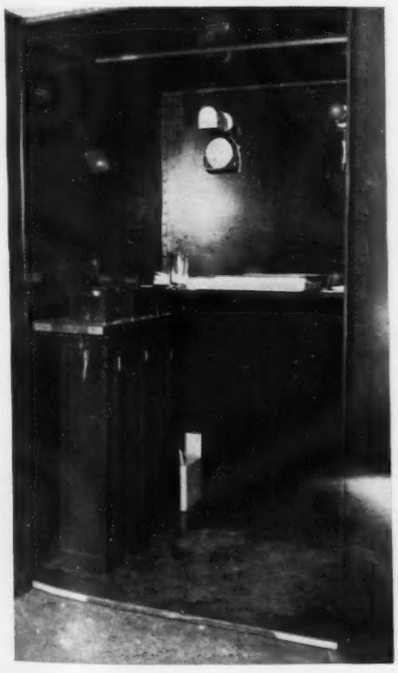
*Twelve months ended December 31.
†Twelve months ended January 31.

Field OPERATING PRACTICES

New ideas and practices in the operation of well-designed constructed and maintained plants and systems

Develop Oscillograms in Cabinet Darkroom

An inexpensive darkroom for developing oscillograph film has been made from an all-steel cabinet in the relay department of the Jersey Central Power & Light Company, Asbury Park, N. J.



Filing cabinet makes effective darkroom

The cabinet used is 4 ft. long, 4 ft. wide and 6 ft. high and is provided with double doors. It was purchased at a cost of about $50. To convert the cabinet for darkroom use all shelves were removed except a 15-in. shelf at the rear that is about 40 in. from the floor. Three tanks 2 x 6 x 40 in. high were constructed to hold developer, wash and hypo solutions, in which the weighted film is hung. Felt around the doors, a safelight, electric clock and trays complete the equipment.

•

Welded Pipes Replace Submarine Cable

WILLIAM D. VANDER SCHAAF
Assistant Engineer Underground and Transmission Construction Department, Public Service Electric & Gas Company

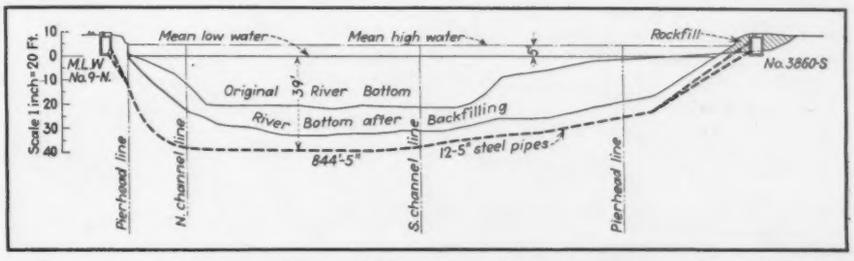
When a dredge operating under government contract on a channel maintenance project worked itself into the submarine cable crossing area approximately 800 ft. west of the Essex generating station, between Newark and Kearny, on the Passaic River, in the summer of 1937, the Public Service Electric & Gas Company of New Jersey was confronted with a major operating problem.

This river is a tidal stream as well as a fresh water drainage basin. At the cable crossing it has a dredged channel 20 ft. below mean low water and a future project depth of 30 ft. below mean low water. Dredging at intervals is required to maintain depths safe for navigation. With these dredging operations in mind, it was decided not to replace the submarine cables, but to install an under-water conduit system.

The system decided upon consisted of twelve steel pipes pulled into a dredged trench. The pipes were to be at least 36 ft. below mean low water between the channel lines and to have a slope upward from the channel line to 5 ft. below river bottom at the low water shore line.

Five-inch extra-strong black steel pipe with 0.375-in. wall was used. It was purchased with belled ends and extra internal collars and was gas welded in the field to form a continuous pipe 840 ft. long. The end to be pulled into the trench was fitted with a welded cap and a "fish nose" for pulling. The opposite end had a welded cap with a fitting for air testing before installation. A length of No. 10 soft-drawn galvanized wire was installed in each pipe as an aid in pulling in the rope for cable pulling.

To pull the pipes into the trench a rack was constructed on one side of the river for guiding, while on the other side a snatchblock was fastened to a buried anchor. The snatchblock was shifted to change the center of pull to correspond with the position of the pipe in the guiding rack. This was done to prevent the pipes from crisscrossing. Approximately three hours of actual pulling time spread over three days was required to pull all twelve pipes into the trench. After installation the trench was examined



26-kv., paper-insulated cable in welded pipe replaced submarine cable under river

HERE'S A NEW, EASY WAY to Improve Your Lighting at Materially Lower Costs

IT'S recognized as excellent management, these days, to improve industrial lighting—using incandescent lamps of higher candlepower in new and modern reflectors, the highly effective G-E mercury-vapor light sources, or the sensational new fluorescent lamps.

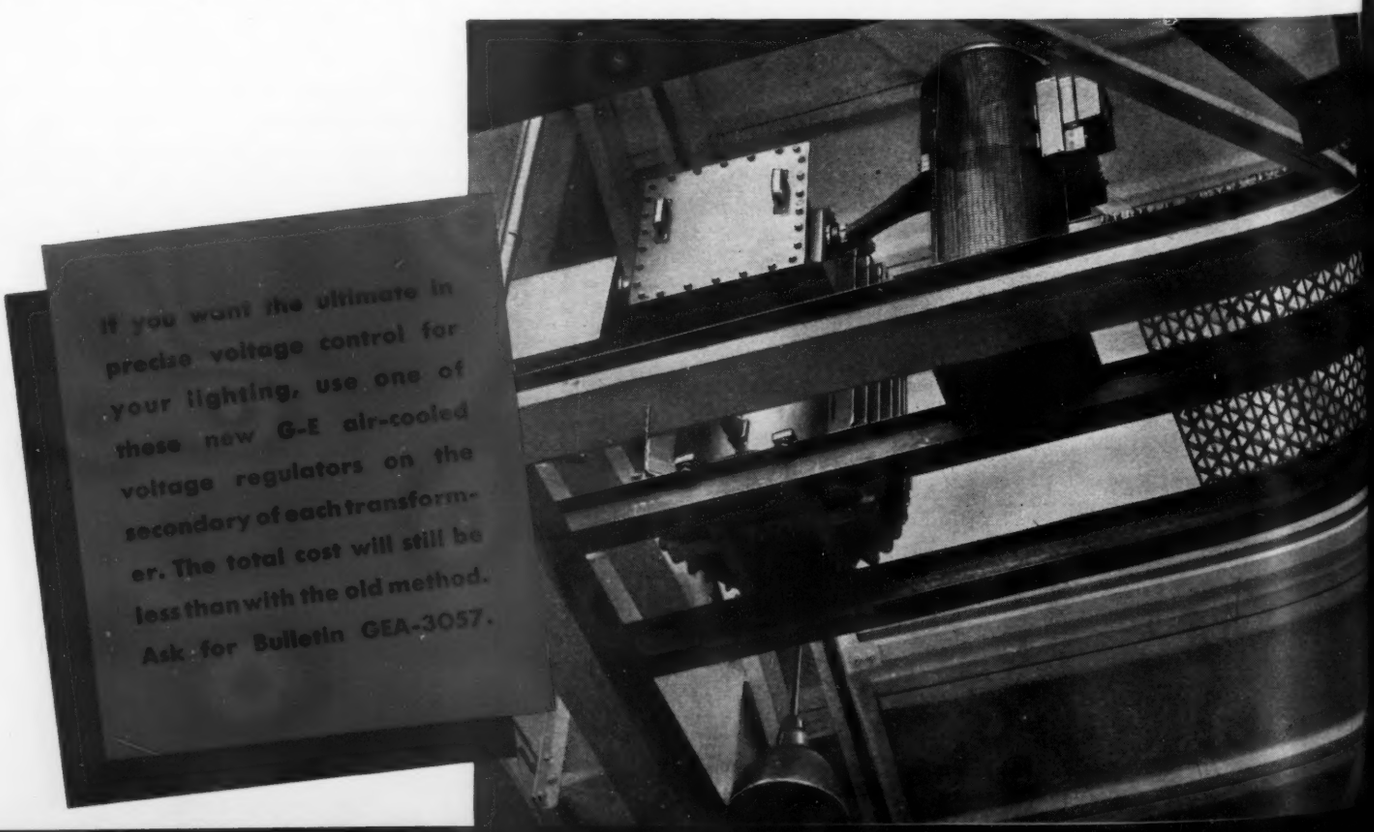
It's a proved fact that better lighting speeds up production, improves quality, reduces spoilage, and steps up morale.

But the big deterrent in the past has been the cost of modernizing the wiring, not the cost of the lamps or reflectors or the cost of operating more powerful light sources.

General Electric, when recently confronted with this problem in its Pittsfield works, turned to one of its products which has been solving many other industrial problems—Pyranol transformers.

Because Pyranol, the liquid in these transformers, is noninflammable and nonexplosive, the transformers can be placed anywhere in the factory, without a fireproof enclosing vault. This meant that we could divide the existing lighting circuit into several short sections, install a small Pyranol transformer near the ceiling to serve each section, and modernize the lighting at a much lower cost than by any other method.

The sketches at the right graphically depict the simple solution. Investigate this method before you relight your next bay, floor, or building—and before making *new* installations—and specify G-E Pyranol transformers for use in your plant. Ask your G-E representative for complete details, or write for Publication GEA-3180. Address General Electric Company, Dept. 6 -201, Schenectady, New York.


If you want the ultimate in precise voltage control for your lighting, use one of these new G-E air-cooled voltage regulators on the secondary of each transformer. The total cost will still be less than with the old method. Ask for Bulletin GEA-3057.

"Fish-nose" for pulling continuous pipe under river

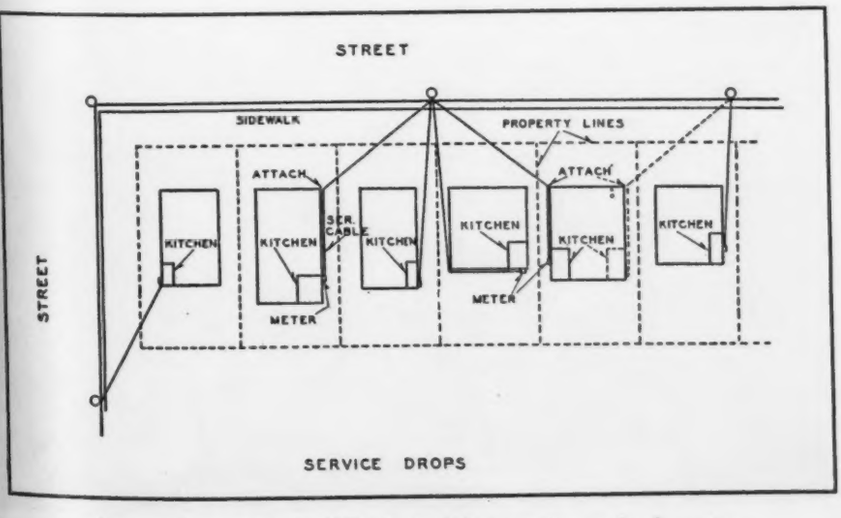
Made up of two ¾-in. steel bars bent to shape and set at 90 deg. to each other. Bars are welded at intersection and along the pipe.

by a diver to see that the pipes were in alignment and at the bottom of the trench. Pipe ends were then boxed into position and the manholes built on either shore.

The trench was filled gradually by the flow of the river. When there was less than 6 ft. of fill over the conduit the trench was backfilled. A minimum coverage of 6 ft. over the entire line was desired to protect against damage from boat anchors.

Attach Service Drop at the Load Center

The practice of attaching customer's residential service drops near the load center, usually the kitchen, is more difficult in the case of street construction than it is with alley construction, especially when lots are narrow and the kitchen is located at the rear of the house. Meter standards of the American Gas & Electric Company show several methods of reaching such load centers under difficult conditions. The standards indicate that the crossing of other property is to be avoided whenever practicable. This company follows the practice of running secondary service up to the outdoor meter, making an appreciable saving to the customer on large capacity services and giving the company control up to the meter.



Narrow lots make it difficult to bring service to load center

Agree on Cross-Over of Utilities and REA

In Iowa the building of REA lines introduced joint-use and the crossing problems with the other utilities and, in particular, with the light and power companies. During the past year an engineering committee of interested parties has discussed this subject and has finally reached an agreement as regards crossing of line. This agreement has been submitted to the Iowa commission, but has not yet been approved. It is as follows:

Supply lines crossing supply lines

1. Where a supply line of higher voltage (15,000 volts and above) crosses a supply line of lower voltage, the line of higher voltage shall cross over the line of lower voltage, and at the higher level, except in such cases as the commission may direct, or as the parties may agree to a modification of this rule.

2. The methods of construction employed shall conform strictly to the minimum requirements of the National Electrical Safety Code and rules that have been adopted from time to time by the Iowa State Commerce Commission and such statutes of the state of Iowa as may be applicable thereto.

3. Jointly used crossing poles shall not be used regardless of voltage of circuits involved except by agreement between the parties thereto.

Charges for crossing construction

4. For ordinary highway crossings involving changing of poles in existing lines, the following amounts, to wit:

	No. of Poles Changed	Height of Poles	Amount Therefor
(1)	2	35–40	$65.00
(2)	4	35–40	85.00
(3)	2	45–50	110.00
(4)	4	45–50	140.00

Such charges shall not apply when height of new poles exceeds 50 ft. or the number of poles required exceed the number above specified.

The above charges are based upon the costs of labor and material at this time, and in the future, if there be a material change in such costs, then the parties may agree with reference thereto, or in the event that they are unable to agree, the Iowa State Commerce Commission shall fix such costs.

The charges designated in four thereof are not applicable to the following construction and classes of lines:

(1) For lines of voltages in excess of 44 kv.
(2) For H-frame lines.
(3) For steel tower lines.

The difficult problem on which to reach agreement is that of common-use or joint-use of pole lines. The committee as yet has not achieved any basic agreement. The commission, however, intimates that the farmers must be served and that both parties must reach an agreemnt. The question of cost involved, of single ownership vs. joint ownership, stand-

ards of construction, safety and public liability questions and even competition, enter into the discussions and make the problem difficult of solution.

The utilities take the position that any use of pole lines shall be only in such bona fide cases where it can be shown by the incoming party that such use is necessary in order to get from one territorial area to another or where electric service is not now available. They also contend that construction should conform to the National Electrical Safety Code or Iowa statutes and that such lines shall be owned and maintained by one or the other of the contracting parties with a rental for use of the pole line by the other party.

•

Big Reels Handle Cable Stocks

By H. G. HALL
Superintendent Underground Lines
Detroit Edison Company

To provide a working stock of all the various sizes, types and voltages of underground cable used on a utility system and maintain this stock in such unit lengths as to fit the multitude of conduit lengths on the system, without undue waste, and with a reasonable investment, is no small problem.

With a view to simplifying this problem, however, a study of the methods of selecting lengths to be purchased was made by the Detroit Edison Company three years ago. It had been difficult up to that time to select the lengths to be stated to the manufacturer for cutting at the factory. The lengths in stock are constantly changing due to the addition of cable removed from the transmission and distribution systems, and the inability to predetermine the lengths to be removed further complicated the problem.

One outstanding point brought out by the study was that the manufacturers could, and would, make and ship all of the sizes and types of cables on reels containing up to 2,500 ft. in one piece, at no extra cost. Here seemed to be an opportunity to make decided savings by buying cable somewhat on the basis that thread and rope are purchased for daily consumption; that is, buy in long lengths for stock and cut off and deliver the exact length required.

From stock reel to field reel

In the background is the large stock reel, from which cable is being taken off and wound on the field reel (in the foreground), which rests on a pair of motor-driven rollers.

In order to take advantage of this reduction in stock, facilities were needed for the handling and storage of these large reels, and also for the quick and easy transfer of cable from large factory reels to smaller field reels. A former machine shop building, on a railroad siding, was equipped with a crane of sufficient capacity to handle the large reels. The material in this building was moved to another location and power-driven rollers and steel stands for supporting the large stock reels were installed in the floor. The empty field reel is set on the power-driven rollers and the end of cable from the stock reel is made fast to it. Power is turned on and the cable is pulled off, measured and wound on the field reel. The rollers are driven by variable-speed motors (salvaged from some discontinued stokers), giving accurate control of the winding operation.

With this mechanical equipment, which was installed at small expense, it is possible to fill an order for cable as quickly as formerly to select a reel of nearest proper length from the storage yard and get it in position to load on the delivery truck. In addition, stock cable is stored where it can be kept warm for immediate use in cold weather.

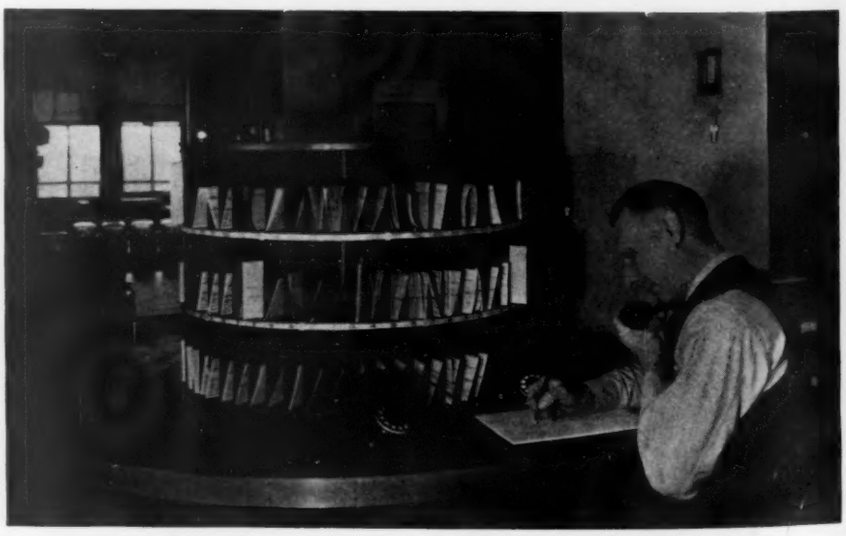
Another factor which has helped in reducing cable stock investment is the use of duct joints on all types and voltages of cable up to and including 25,000 volts. We have found it profitable to duct splice into suitable lengths pieces of salvaged cable which are 35 ft. or more in length. The combination of long lengths and duct splicing represents an annual reduction of about $30,000 in the cost of maintaining the cable stock.

•

Devise Special Table for Meter Dispatcher

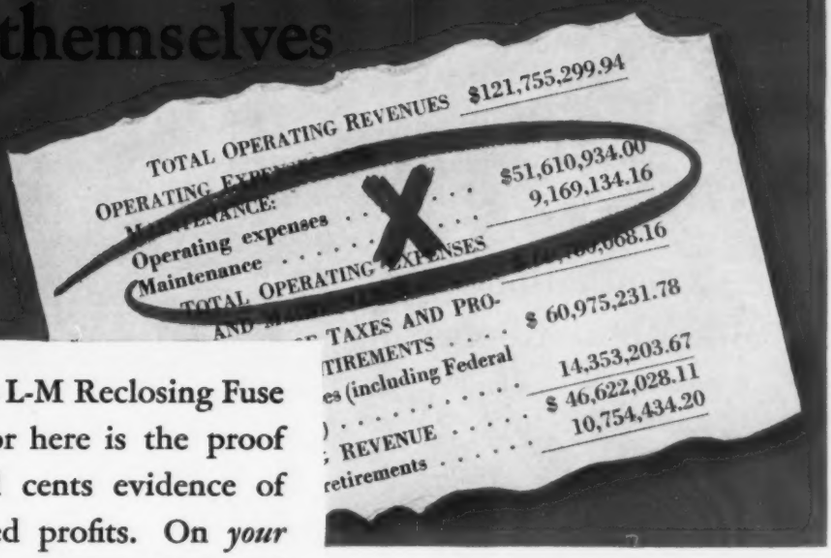
Information on the status of any active meter work order is brought quickly to the fingertips of the meter dispatcher of an Eastern power company by the illustrated work dispatch table. This table is provided with a rotating drum having three tiers of pigeonholes in which the work orders are conveniently cross-referenced.

Three pigeonholes are provided in the top tier for each meter man, in which he keeps copies of orders assigned to him. These holes are labeled with the man's name and "To Go," "In Field" or "Finished Work." Each compartment in the second tier contains orders scheduled for execution on a certain day of the month. These orders are cross-referenced by arranging copies alphabetically by street names in the third tier of slots.

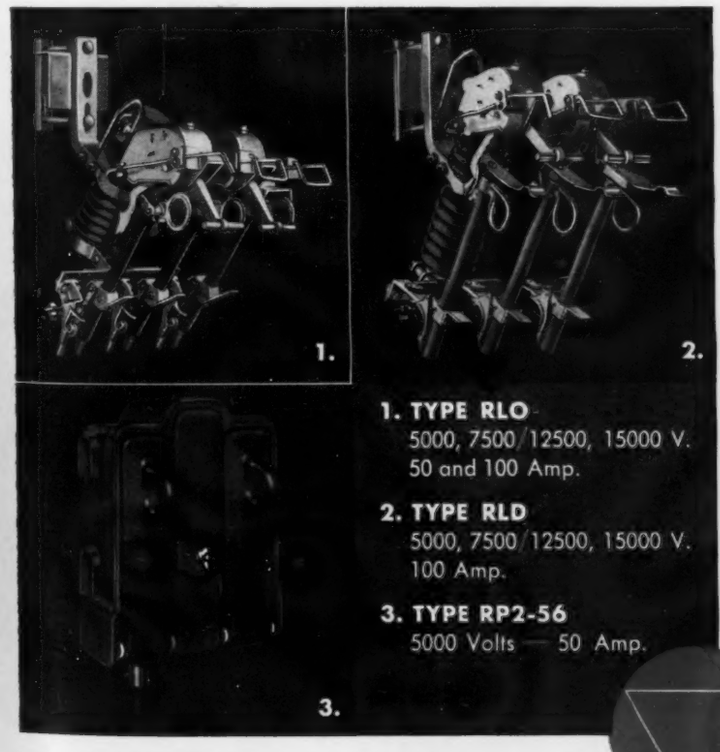


Rotating order file a convenience to meter dispatcher

X marks the spot where L-M Reclosing Cutouts Pay for themselves



In utility financial statements L-M Reclosing Fuse Cutouts "rest their case". For here is the proof that counts, the dollars and cents evidence of decreased costs and increased profits. On *your* lines, too, L-M Reclosing Cutouts assure decreased outage losses, fewer troubleman's trips, increased profits per Kilowatt-Hour, improved customer relationships . . . that's how L-M Reclosers save you money and trouble, and *pay for themselves.*



1. TYPE RLO
5000, 7500/12500, 15000 V.
50 and 100 Amp.

2. TYPE RLD
5000, 7500/12500, 15000 V.
100 Amp.

3. TYPE RP2-56
5000 Volts — 50 Amp.

Get These L-M Reclosing Features:

FULLY AUTOMATIC OPERATION . . . nothing to "cock", nothing the lineman must remember to do, and impossibility of two fuses being in parallel.

UNMISTAKABLE INDICATION . . . L-M Reclosing Cutouts have only two positions, the normal "Up" position and the "Dropout" position, no confusing third or intermediate position. One quick glance from the ground tells the exact condition of the cutout.

FIRM, SURE CONTACTS . . . L-M Cartridges are positively latched in the "Up" position. They cannot drop out of contact due to vibration. They are "Up" till the fuse link blows.

BELLOWS TIME DELAY . . . insures a fault-clearing time lapse between opening and reclosing the circuit, prevents needless blowing of a second fuse.

Standardize on L-M Reclosing Fuse Cutouts . . . they pay for themselves.

LINE MATERIAL CO.

Industrial ELECTRIFICATION

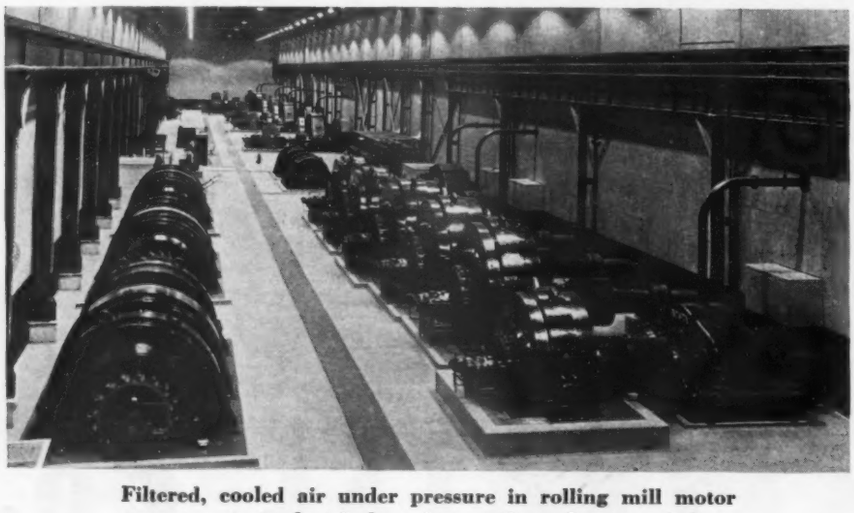
New ideas and practices in industrial electrification as presented by industrial, consulting and power sales engineers

Special Ventilation for Mill Motor Room

Major electrical equipment for the 80-in. continuous hot-strip mill of Carnegie-Illinois Steel Corporation's new Irvin Works near Pittsburgh, Pa., is protected from fumes and metal dust in a special motor room. Here cooled, filtered air under slight pressure prevents infiltration of dust that might damage insulation and bearings. The ventilating system for this room is designed to handle 525,000 cu.ft. of 95 deg. F. air per minute. Air discharged from the machines at 125 deg. F. is reduced to 95 deg. by a cooling system that circulates 4,100 gallons of water per minute at 85 deg. F.

The mill motor room, which is 65 ft. wide and 700 ft. long, houses all the main mill motors, gear drives, motor-generator sets and metal-clad switchgear equipment representing 51,500 hp. in a.c. motors, 27,500 hp. of d.c. motors and 27,000 kw. of motor-generator sets.

Power for this equipment is supplied at 6,600 volts to the motor room switchboard from the Irvin Works substation. This substation has three 69,000/6,600-volt transformer banks of 25,000 kva. normal capacity or 33,000 kva. under forced ventilation. Supply to the substation is over two 69,000-volt feeders from the interchange system.



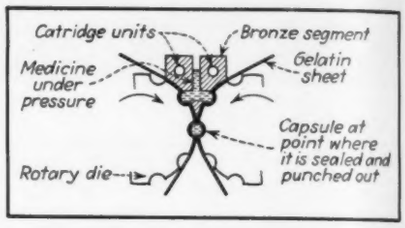
Filtered, cooled air under pressure in rolling mill motor room protects electrical equipment from fumes and dust

Apply Electric Heat to Capsule Machine

By A. L. LANE*
Detroit Edison Company, Detroit, Mich.

Recent advance in the manufacture of medicine-filled gelatin capsules has been a development of a remarkable rotary die capsule machine by the Gelatin Products Company which uses electric heat at five strategic points. With this new machine accuracy of fill is controlled to within less than 1 per cent and production capacity of machine has been increased 500 per cent.

* Abstract of the prize-winning paper in the General Electric Industrial Heating Contest for power sales engineers of utility companies.

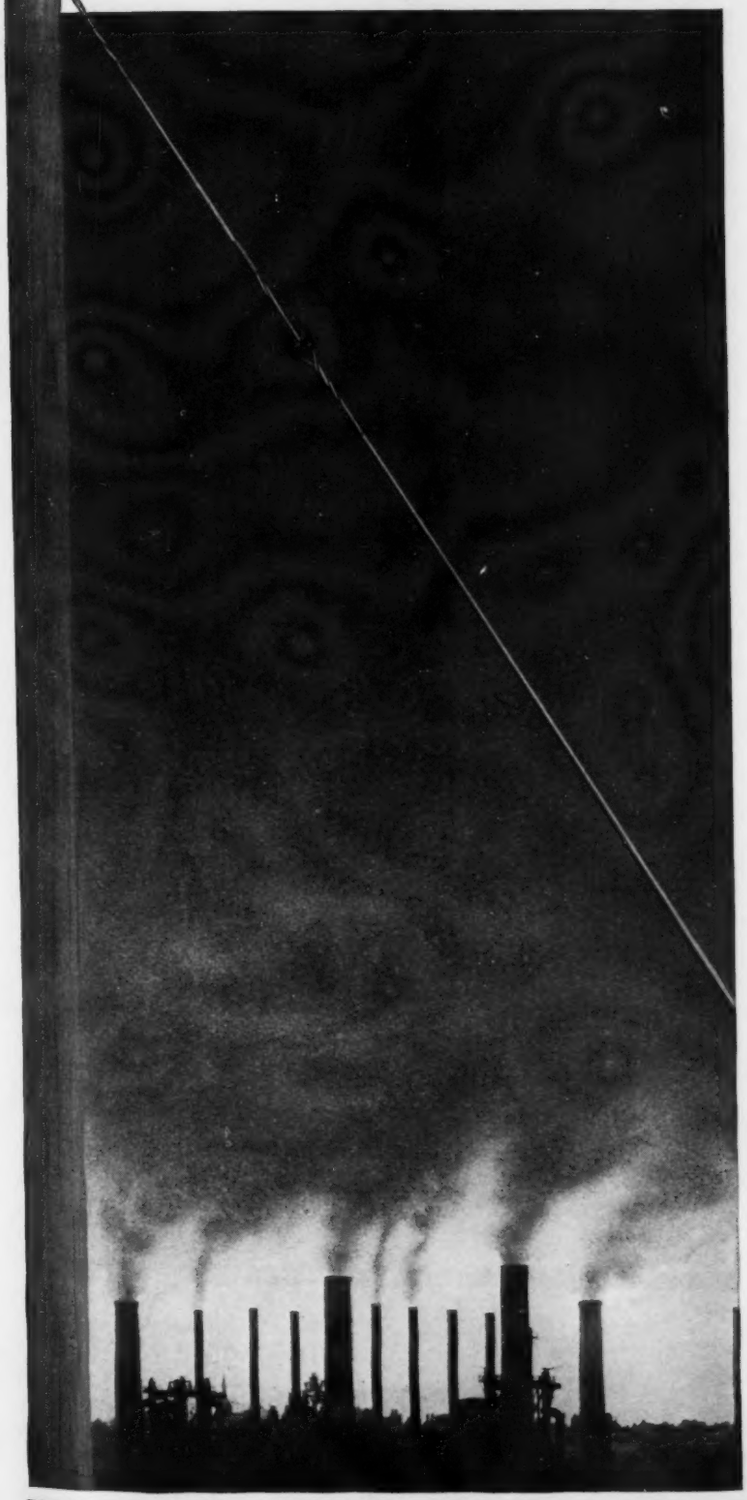


Cartridge units keep gelatin plastic during filling of capsules

Melting down of the gelatin for the machines in forty 50-gal. containers was the first problem in the application of electric heat to this process. To facilitate loading and unloading, these containers had to be portable and easily moved to and from the heat source. Since gelatin has a low coefficient of heat conductivity, use of an immersion heater directly in the material was not practical. It was necessary to water jacket the container and heat the water by an immersion unit. The water jacket was designed for 14 gal. Energy to bring the jacket water, gelatin, aluminum container and steel shell of the container to the desired temperature of 145 deg., from room temperature, was calculated by the customary method and found to be 9.461 kw.-hr. Taking account of the losses from the water jacket through ½ in. of hair felt and allowing 24 hours for heating it was obvious that a 1-kw. immersion unit should be selected. A thermostat was installed adjacent to the immersion heater to control temperature.

When the gelatin reaches 145 deg. the container is moved to the machine room and plugged into an outlet to hold the temperature. Charges of 3 or 4 gal. are taken from the container

BETHANIZED STRAND



unfazed by- SMOG SOOT WEATHER

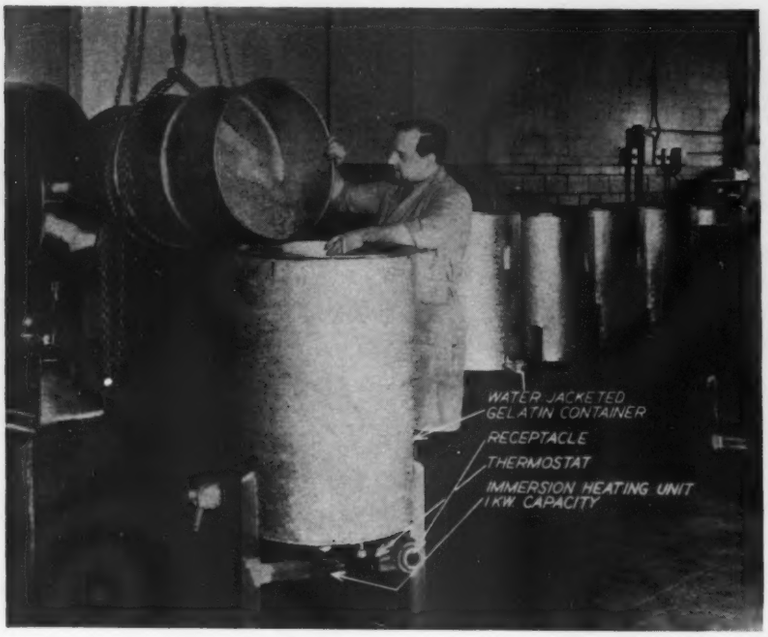
WHERE highly corrosive conditions have caused rapid failure of regular guy or ground-wire strands, look to Bethlehem. Almost without exception we can supply you with strand that takes the heaviest punishment in its stride. Bethanized strand can be made with much heavier coatings than it was ever possible to supply in galvanized strand. In bethanized strand the A-coating carries the same weight of zinc as standard double or charcoal-wipe galvanizing. B-coating bethanized strand has just twice as much zinc; C-coating strand has three times this amount. If conditions warrant it, bethanized strand can be made with even heavier coatings.

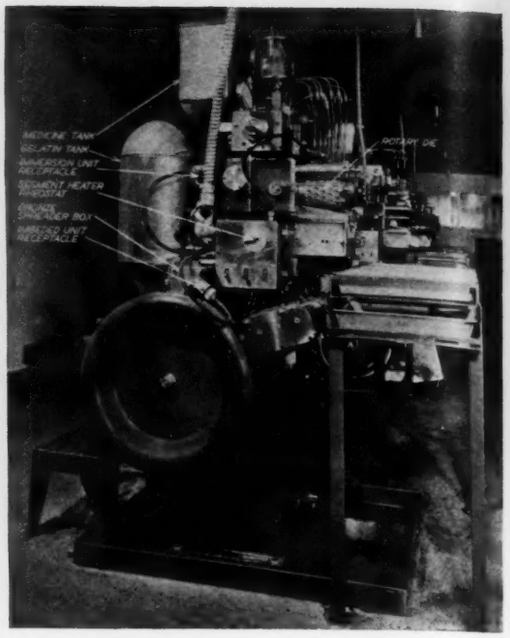
The bethanizing process, regardless of the weight of zinc, produces a coating that is better in three ways. Zinc applied by this electrolytic method is extremely pure. The zinc, regardless of the amount, is uniformly distributed around the wire, entirely free from thin spots. Finally, because the pure zinc is bonded directly to the steel with no layer of brittle zinc-iron alloy, the coating is highly ductile. Even the heaviest coatings will not crack, flake, or peel under the action of splicing or clamping.

Bethanized strand with the A-coating is priced the same as standard double galvanizing. Heavier bethanized coatings cost slightly more than galvanized, but are considerably less expensive than non-ferrous strand. Pick out the locations where strand takes the worst punishment and try bethanized strand in them. Bethlehem engineers will be glad to recommend the proper weight of coating.

BETHLEHEM STEEL

BETHLEHEM STEEL COMPANY





Development in capsule production made possible by electric heat

Forty electrically heated portable containers (left) that bring gelatin to melting point are later transferred to machine room and connected to outlets adjacent to rotary die capsule machines (right). Five heating units keep gelatin at proper working temperature during forming

and poured into the tank on the capsule machine. This tank is heated to keep the gelatin from becoming viscous. Here again an insulated 1½-gal. water jacket was used. Calculations showed that a 250-watt immersion heater, with a thermostat to maintain the temperature at 140 deg., was needed.

From the tank the gelatin enters a "V"-shaped, cast-bronze spreader box, at the point of which are two 0.020 x 5½-in. slots through which the gelatin flows in a sheet onto the machine's die cylinders. These cylinders deliver the sheet to the final stage of the process, when it is formed into capsules and filled. Tests showed that gelatin temperature of 130 deg. was necessary at the slots to give proper consistency. Assuming an entering gelatin temperature of 130 deg., only enough heat was necessary to supply radiation losses from the casting and convection losses from the gelatin sheet. These losses were calculated as 29.2 and 57 watts respectively, allowing use of a 100-watt unit. Since a unit could not be cast in the existing spreader box a groove was machined in the part and a resistance wire embedded in a porcelain cement in the groove.

In the final stage the two sheets of gelatin pass over a "V"-shaped segment (see sketch) and between rotary dies having depressions the size of half a capsule. Medicine under pressure passes through metering valves and an opening in the segment, forcing the soft gelatin into depressions in the dies. As the gelatin sheets slide off the point of the segment the depressions come together, forming a sphere filled with medicine, which is punched out and sealed by the cohesive action of the gelatin. Since forming and sealing of the capsule depend on gelatin temperature and temperature of the medicine, the "V" segment was drilled and fitted with two cartridge type heating units, the capacity of which can be from 60 to 100 watts.

Medicine in a 3-gal. water jacketed tank is kept at 108 deg. F. by a 100-watt immersion unit and thermostat. The medicine is circulated by a 1/100-hp. motor and propeller.

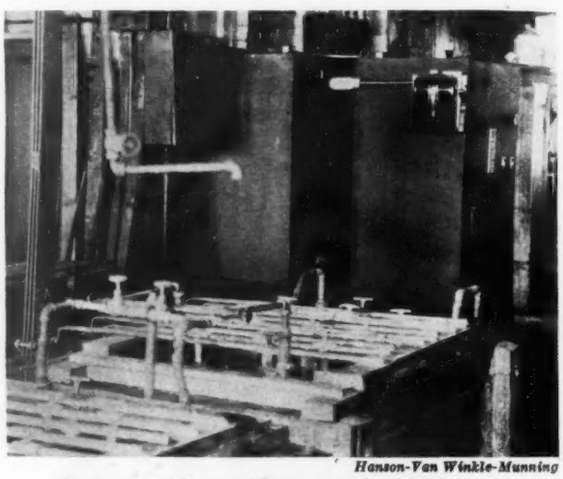
Use CuO Rectifiers for Electrotyping

By J. B. THOMSON
President Shane-Beever Company, Baltimore, Md.

What is believed to be the first large installation of copper oxide rectifiers in the electrotyping industry in this country has been made at the Baltimore plant of the Shane-Beever Company, where two heavy-duty units replaced d.c. motor-driven motor-generator sets.

The two rectifiers have a capacity of 3,000 amp. at 6 volts and are supplied from the plant distribution system through a step-down transformer that reduces supply voltage to six volts. Use of the rectifiers permitted a change from direct current to alternating current for power supply. They replaced two 1,500-amp. m.g. sets.

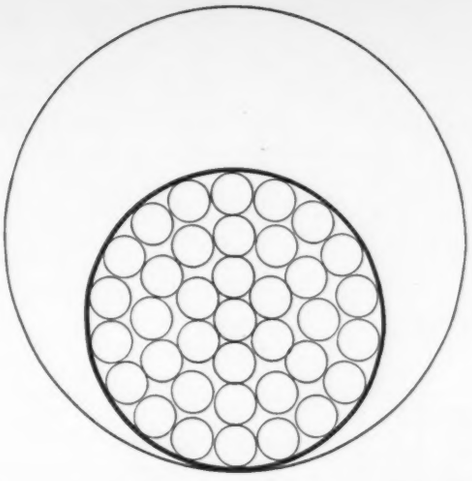
Installation cost of the rectifiers was about half that for a motor-generator set, and although the rectifiers have been in operation but a matter of months, performance over this period has been satisfactory.

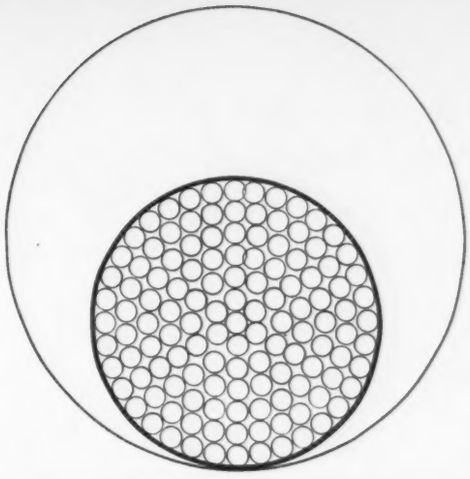


Hanson-Van Winkle-Munning

Copper oxide rectifiers supply 3,000 amp. to plating bath

More Conductors . . . — Better Insulation





In these two drawings we have a purely hypothetical case which shows the tremendous savings possible by using Simplex-LATOX insulated cables. It is possible to get 127 No. 12 solid LATOX insulated conductors into a conduit and not take up any more space than 37 No. 12 solid conductors insulated in the ordinary way.

Conductors insulated with conventional rubber insulation fill up ducts in a hurry. These cables have thick conductor walls and it only takes a few of these conductors to fill an ordinary size conduit. LATOX cables on the other hand are small - 30 to 50% smaller than ordinary cables.

If you have conduits that are filled with the older type cables you can get a greater number of circuits into these conduits by replacing the old cables with Simplex-LATOX cables. LATOX cables can be smaller and still be dependable because the rubber wall of insulation on each conductor is all insulation. The rubber content of LATOX insulation is 93%.

When you use Simplex-LATOX cables you can use every allowable bit of space in your conduits. There is no waste space with LATOX cables. Simplex-LATOX rubber insulation – used in all Simplex-LATOX cables – was developed in Simplex laboratories to meet a definite need caused by the conditions under which you work today. It was designed to reduce weight and bulk and at the same time improve those physical and electrical properties necessary for efficient conductor insulation.

The advantages of lighter weight and smaller diameter are combined with the higher electrical and physical properties that LATOX insulation provides to give ideal performance for communication, signal and control cables.

Simplex Wire & Cable Co., 79 Sidney Street, Cambridge, Mass.

Simplex – LATOX

Thin insulation made directly from rubber latex

New ENGINEERING IDEAS

Discoveries, proposals and developments by electrical engineers and scientists in the field, the factory and the laboratory

Unbalanced Currents In Parallel Cables

By R. M. SENSINTAFFAR
Electrical Design Section,
U. S. Bureau of Reclamation,
Denver, Colo.

When heavy currents are carried by the use of cables it many times requires cables connected in parallel. Since the cables are displaced physically from each other, each group of paralleled cables will have a short-circuited loop or loops. The magnetic flux from the currents in these cables and adjacent cables will induce a voltage in all of these loops which it links and will produce a circulating current. This circulating current will increase the current in some of the cables and decrease the current in other cables. The total current is the factor which determines the size of the cable, and therefore it is important to know the division of current for untransposed paralleled cables.

Referring to diagram (a) the voltage induced in the circular conductor a of radius r due to the current I_a which it carries is

$$\omega I_a (1/2 + 2 \log_e 1/r) \qquad (1)$$

The voltage induced in this same conductor due to a current I_b in conductor b and in the same direction as I_a is

$$2 \omega I_b \log_e 1/d \qquad (2)$$

where d is the distance from a to b and ω is 2π times the frequency. The voltage induced in a due to a current $(m + jn)$ in reference to I_a is the same as equation (2) except I_b is replaced by $(m + jn)$. The total voltage induced in a is the vector sum of all the voltages from the current in a and all other currents in conductors adjacent to a.

The voltage drop between points 1 and 2 is the same for each conductor. If the effective resistance is R and the vector sum of all the voltages induced in the conductor is V, then

$$R_a I_a + jV_a = R_b I_b + jV_b = R_c I_c + jV_c \qquad (3)$$

$$I_a + I_b + I_c = I \qquad (4)$$

V_a, V_b and V_c are all functions of I_a, I_b and I_c. The expressions for the induced voltage can be written from equations 1 and 2. Then by substituting these values in equations 3 and 4 the currents can be obtained.

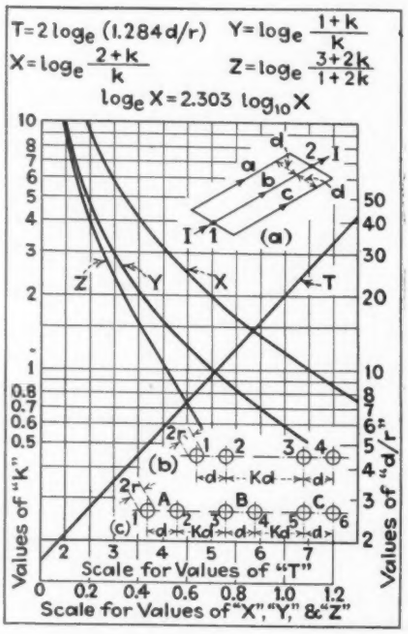
Referring to diagram (b), conductors 1 and 2 and 3 and 4, respectively, are in parallel, forming a single-phase circuit. Applying equations 1 to 4 to this circuit and changing from absolute units to practical units the current in conductors 2 and 3 is

$$I_2 = I_3 = \frac{I}{2}\left(1 + \frac{X}{T + X - 2Y - j87R}\right) \qquad (5)$$

in which I is the total circuit current, T is a factor taken from the graph for the corresponding value of d/r, d and r are in the same units and R is the effective resistance in ohms per 1,000 feet. The factors X and Y are taken from the graph for the corresponding value of k, which equals kd/d.

The above is for a frequency of 60 cycles and may be corrected for other frequencies by multiplying the factor 87 by $60/f$. The currents I_1 and I_4 are equal and can be obtained by changing the plus sign after the 1 in the brackets to a minus sign or by taking the difference between I and I_2.

Referring to diagram (c), conductors 1 and 2, 3 and 4 and 5 and 6, respectively, are in parallel, forming a balanced three-phase circuit. The currents A_1 and C_6, A_2 and C_5, and B_3 and B_4 are equal because of the symmetery of the arrangement. Solv-



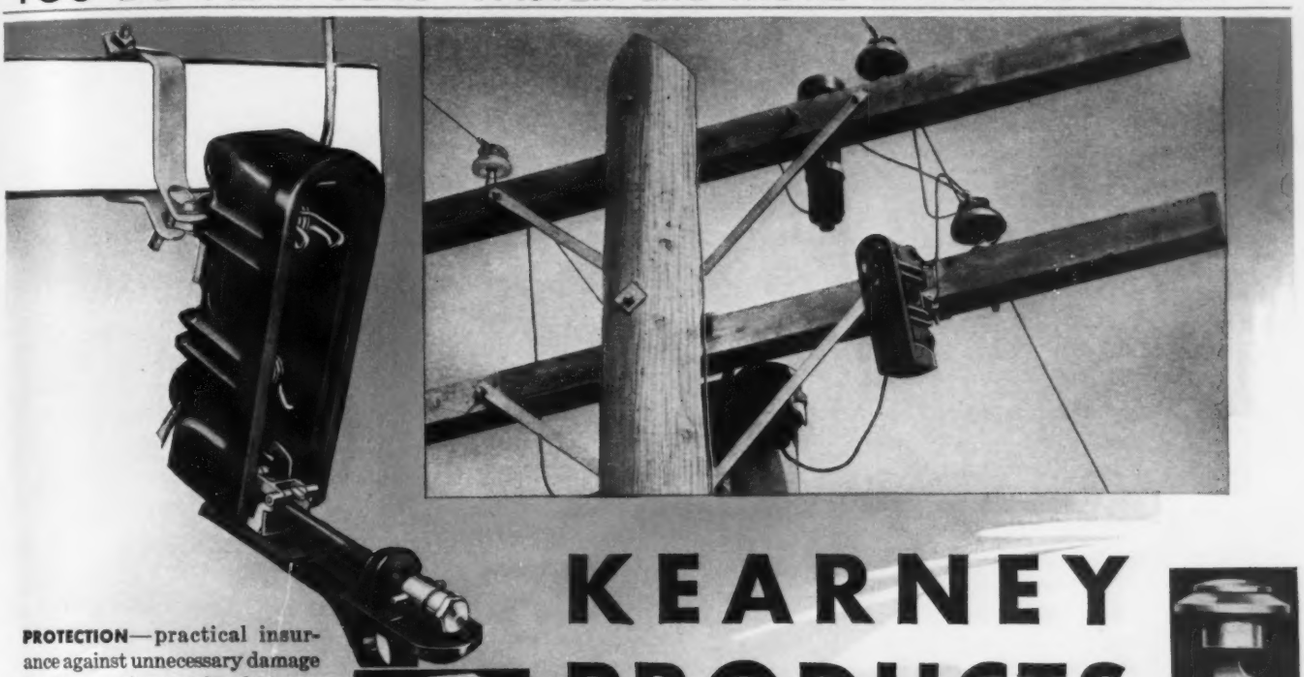
Equation determines current distribution in loops formed by paralleled cables

Assume an arrangement as shown in diagram (c), consisting of six 600,000-circ.mil. cables carrying 1,000 amp. per phase with $d = 3$ in. and $kd = 4$ in. From a cable data table $R = 0.021$ ohm per 1,000 ft., $r = 0.45$ in., and the skin effect ratio = 1.03. For $k = 4/3 = 1.33$ the corresponding values of the constants from the graph are $X = 0.915$ and $Z = 0.433$. For $d/r = 3/0.45 = 6.67$ the corresponding value of T from the graph is 4.30. It follows then from equation 6 that the approximate value of the current in conductors 2 and 5 is

$I_2 = I_5 = 548 + j69 = 553$
$I_1 = I_6 = 452 - j69 = 457$
$I_3 = I_4 = 500 + j0 = 500$

The above shows that there is a circulatory current of 48 + j69 amps. flowing in the short-circuited loops of the two outside phases which is adding to the current in one of the paralleled conductors and subtracting from the other conductor.

YOU DO NEAT JOBS—FASTER *and* MORE EFFICIENTLY WITH—



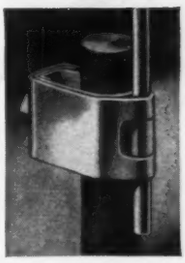
KEARNEY PRODUCTS

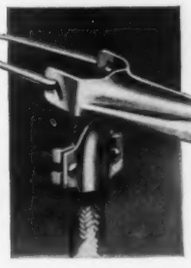
PROTECTION—practical insurance against unnecessary damage to your equipment is what you have when you install Kearney Trip-O-Matic Cutouts on your lines . . . and as this cutout protects, it gives visual indication of the outage—the door trips out.

CONNECTION—quickly, safely and conveniently made with genuine Kearney Solderless Wire Con-Nec-Tites that have the patented full round washer to provide maximum strength and conductivity.

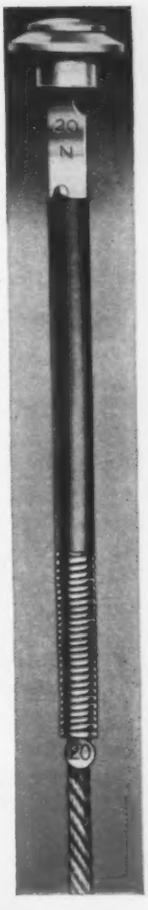
GOOD GROUND—positive grounds that won't loosen under expansion, contraction, or vibration—to cause trouble—are easily made, even over battered rod heads, with modern, wrap-strap design Ground Clamp-Tites.

SECURE LINES—lines today are securely held, without damage to cable insulation, by means of Kearney Dead End Service Clamps that incorporate Clamp-Snub design to safely and positively carry their cable weights.





YOU REDUCE possibilities of costly service interruptions — assure greater continuity of service and customer goodwill — lower maintenance costs and do neat jobs—faster and more efficiently when you use time and field-tested Kearney Products . . . There are Kearney Trip-O-Matics—approved and used by operators everywhere who recognize the need and economy of better protection for their distribution systems . . . Kearney Con-Nec-Tites—exclusively designed with patented full round washers to provide proper mechanical and electrical characteristics for greater strength and conductivity . . . Improved Kearney Ground Clamp-Tites . . . Sure-holding Kearney Dead End Service Clamps that are used by the thousands. These are time and money-saving accessories you need to cut costs.



AND REMEMBER—KEARNEY FUSE LINKS are made to blow or not to blow—as protective requirements demand. Be sure to ask about them.

FOR PROFITABLE DATA ABOUT SWITCHING ACCESSORIES SEE BULLETIN 312

JAMES R. KEARNEY CORPORATION

DESIGNERS AND MANUFACTURERS OF OVERHEAD AND UNDERGROUND

UTILITY EQUIPMENT

4224-42 CLAYTON AVENUE SAINT LOUIS, MO.

ing for the division of the current it follows that

$$I_2 = I_1 = \frac{I}{2}\left(1 + \frac{(X+Z)+j\,1.73\,(X-Z)}{2T - j174R}\right) \quad (6)$$

in which I is the total current per phase, X and Z are factors whose values can be obtained from the graph for the corresponding value of k, and T is a factor whose value is obtained from the graph for the corresponding value of d/r. The currents in conductors 1 and 6 may be calculated by changing the plus sign after the 1 in the brackets to a minus sign or by taking the difference between I and I_2.

The above equations assume that the vector sum of all the currents in the circuit is equal to zero, that the effect of the current in all conductors is considered and that there is no magnetic material near the conductors to produce additional flux.

•

Impulse Generator Compact and Flexible

By JOHN R. GASTON
Manager Industrial Transformer Division, American Transformer Company, Newark, N. J.

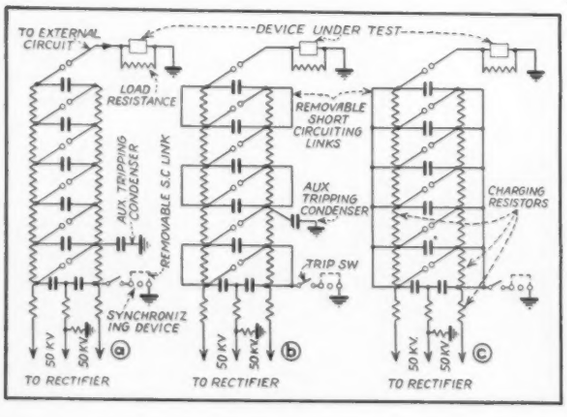
Special design innovations specified by the American Transformer Company have provided a compact double-duty surge generator, capable of functioning either as a current or a voltage surge generator with but a few simple changes. The unit, which is to be used for routine impulse tests, was developed by the Westinghouse Electric & Manufacturing Company and has an energy output of 15,000 watt-seconds.

Economy of space is secured by arrangement of condenser shelves in a square with the shelves at different levels. Half of the charging resistors form four columns inside of the shelf square. The rest form a continuous fifth column in the center that carries the supports for one sphere of each series discharge gap. Each condenser is connected between the center column and one of the four corner columns through a dampening resistor.

With the generator's twelve ¼-mfd., 100-kv. condensers discharging in series 1,200,000 volts is attainable. Currents of 10,000 amp. can be obtained at this voltage. By connecting the capacitors in parallel during discharge surges of 75,000 to 100,000 amp. at 100,000 volts can be obtained, and with series parallel arrangements intermediate values of current and voltage can be had. Output can be doubled by the addition of twelve more condensers, making two condensers per shelf. Also, 2,400,000 volts can be generated by the addition of another set of columns on top of the present generator.

Capacitor units are charged in parallel to 100,000 volts d.c. from a conventional kenetron half-wave voltage doubling rectifier. To obtain the maximum voltage impulse the capacitors are discharged in series through a number of sphere gaps as shown. To discharge the capacitors in parallel or in series-parallel combinations a simple short-circuiting link is provided for insertion across resistances, as shown in the accompanying sketches, effectively paralleling capacitors and giving high-current, low-voltage surges.

To trip the surge in the case of the series and series-parallel connections an auxiliary condenser connected to the bottom sphere gap is discharged through a resistance (on closing the trip switch) in such a way as to add to the voltage across the bottom sphere gap, causing it to break down and cascade the other gaps, connecting the capacitors or groups of capacitors in series. In the case of the parallel connection the top sphere gap is carefully adjusted to breakdown when the trip switch is closed and the 100,000 volts of the fully charged capacitors connected across it.



Combined voltage and current surge generator in one unit

(a) Charged in parallel and discharged in series gives maximum voltage. Insertion of short-circuiting links permits series-parallel (b) and parallel connection (c) of condensers on discharge for intermediate and low-voltage surges. The diagrams are schematic only and show but half the condensers.

•

Transformer Size for Combination Ban

By BERTRAM E. ELLSWORTH
Electrical Engineer, Iowa-Nebraska Light & Power Company, Lincoln, Neb.

Single-phase transformers are ordinarily employed in serving distribution loads, both power and light. The accompanying chart gives the

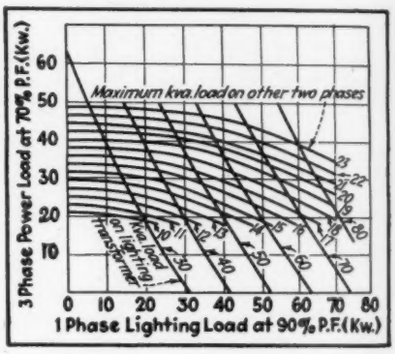


Chart determines transformer size for combined light and power loads

kva. loading on the individual transformers of such a bank serving both lighting and power loads when connected delta-delta. These data do not apply to the Y-delta connected bank or to three-phase transformers.

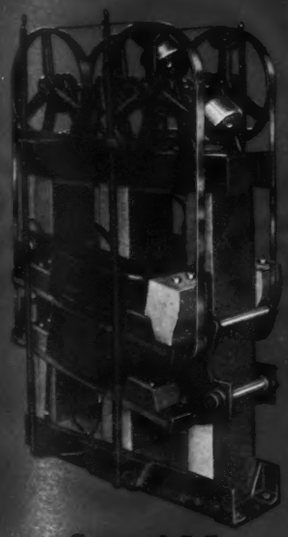
For purposes of the chart lighting load is assumed to be at 90 per cent power factor and the power load at 70 per cent power factor. As an example, assume a single-phase lighting load of 50 kw., all on one phase, and a three-phase power load of 20 kw. Locate the points of intersection of these values on the graph. From the vertical curves the transformer on the lighting phase will be found to carry 60.5 kva. and from the horizontal curves the maximum load on the two others will be found to be 15.2 kva. each. From these the proper size of transformers for the load can be selected. The impedance values used in preparing these curves were those of the standard 2,400-120/240-volt, 60-cycle transformers of sizes ordinarily used for these loads.

THESE MOLONEY Constant-Current Street-Lighting Transformers will SAVE MONEY FOR YOU!

TYPE SLS
(for Subway Service)

TYPE SLE
(for Pole-Mounting)

TYPE SLC
(for Pole-Mounting)



Core and Coil Assembly

THE improved electrical and mechanical design of these units results in longer lamp life and lower transformer maintenance costs. Reduction of these expense items results in actual dollars saved.

THE MOLONEY double-moving-coil type of construction provides one of the flattest regulation curves obtainable. Truly *constant* current... necessary for maximum lamp life... is available from maximum load down to dead short circuit.

YOU will find that maintenance costs are at a minimum with these Street Lighting transformers. Both laboratory endurance tests and operating records of transformers in actual service testify to their ability to withstand unusually severe service conditions with extremely low maintenance costs.

MOLONEY Constant Current Street Lighting Transformers are available for pole, subway, and station installation. For further information regarding these transformers, write for Bulletin CC-380301. Moloney Electric Company, St. Louis.

MOLONEY TRANSFORMERS

Building Up THE LOAD

New ideas and practices in selling electrical equipment and service to commercial and domestic customers

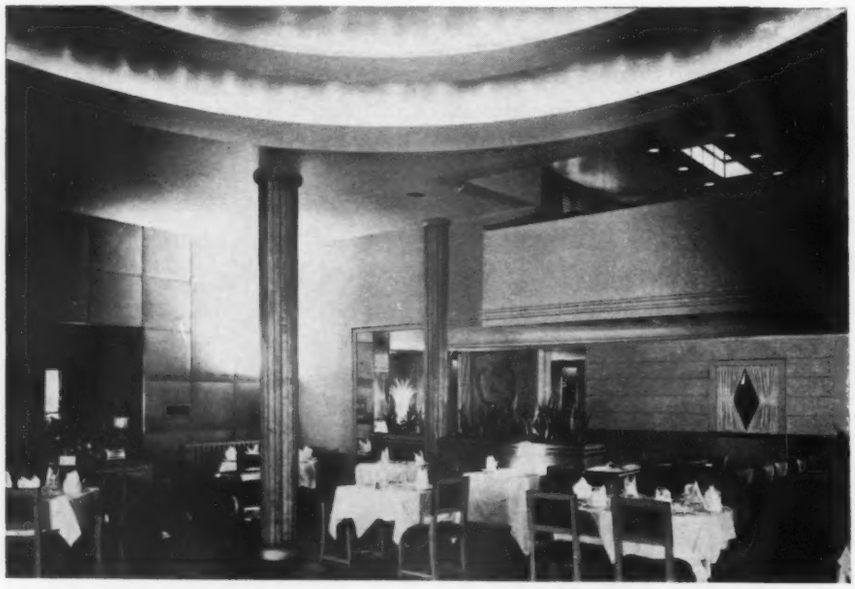
Conversion Results in 5,100-Watt Load

By L. M. DURYEE
Industrial Power Engineer
Connecticut Light & Power Company,
Waterbury, Conn.

When the Elton Hotel, Waterbury, Conn., went modern recently the management turned very naturally to the use of light as an effective medium.

The new Copper Room in the Elton was created last spring out of space formerly occupied by an old dining room. Soft, diffused lighting prevails throughout, yet it is so designed as to intensify the feeling that one is in an entirely different world. In the ceiling, and directly above the black, shimmering dance floor, concentric circular domes hide 300 10-watt lamps, the light from which merges nicely into the warm tint of the walls. It also lights the four copper-colored pillars which support the ceiling. At the far end of the room, where the orchestra plays, fluorescent lamps sunk in hidden troughs splash white light on the modernistic walls. Directly behind the orchestra stand two copper columns lighted with continuous rows of lumiline lamps on each column. Copper urns and a few hidden fixtures along the walls provide additional light at effective intervals. The bar, located just off the Copper Room to the left, also makes effective use of a large number of lumiline lamps and increases the apparent width of the room very noticeably.

The total installed load in lighting is 5,100 watts. Under the two-part power schedule of the Connecticut Light & Power Company this room is lighted at small expense compared to the very substantial increase in business which the Elton has enjoyed since the Copper Room was established.



Modern decorations combine with 5,100 watts of lighting to convert old hotel dining room into swanky night spot

Larger Power Sales to Oil Refineries

By R. E. FREY
Kansas Gas & Electric Company, Wichita

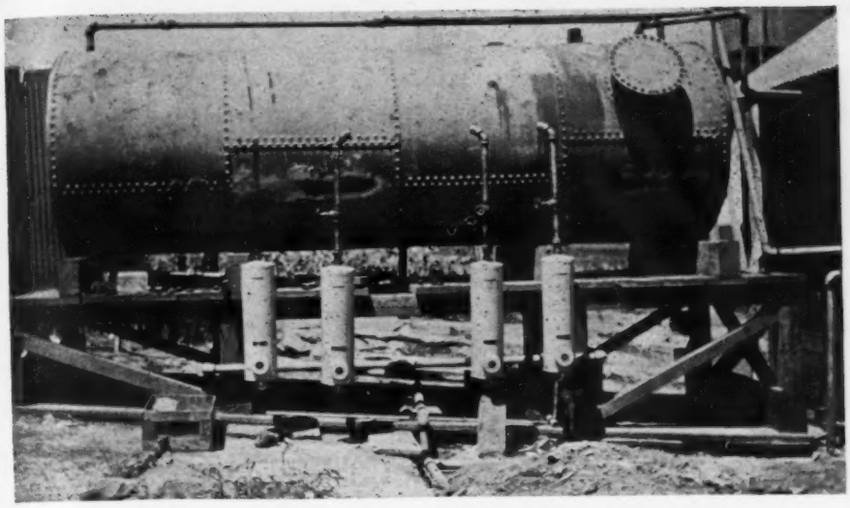
Improvements in oil refining are making many changes in processes and equipments, and these, without any consideration of replacement of existing steam and gas engine power, offer large opportunity for sale of central-station service. This condition appears clearly in the following listing of new refinery business obtained in recent months by the Kansas Gas & Electric Company:

60-hp. crude oil charge pump replacing three steam-driven pumps.
33 hp. in motors—a new installation on gasoline pumps.
75 hp. in pumps in connection with a new cooling tower.
20 hp. on a new vacuum unit for the production of asphalt.
85-hp. reflux and crude charge pumps replacing steam-driven units.
70-hp. gasoline-treating unit.
155-hp. circulating water pumps on a cooling tower.
175 hp. in connection with a new gasoline-treating unit.
700 hp. in connection with the hydraulic decoking of coke chambers.

1,373 hp. total.

Out of the total 1,373 hp. connected, only 145 hp. replaced existing drives and 1,228 hp. was for new process load, indicating that new-business prospects for the present and the immediate future result mostly from modernization changes.

Indications in the K.G.&E. territory point to the gradual replacement of steam-driven reciprocating pumps by motor-driven centrifugals, largely due to growing obsolescence of boiler plant equipment and to realization by refinery managers of the lower investment and operating cost of electric equipment. For the years 1937 and 1938 the actual annual increase in killowat-hours per



Boiler and heater units under installation at large farm added 180 kw. of water heating to Pacific Gas & Electric lines

barrel in our territory varied from 15 to 20 per cent. From present indications the increase for 1939 will be approximately the same.

In October, 1938, the industrial power and heating committee of the Edison Electric Institute published a report on electrification of oil refineries in which it was estimated that refinery power sales had an increase potential of 37 per cent above sales at the time of data collection for the report, presumably a year or more earlier than publication. Apparently the conservative estimate of potential increase in the report will be largely exceeded.

•

Water Heating Job Nets Company 180 Kw.

By **DOUGLAS HELLER**
Sales Supervisor, San Joaquin Division, Pacific Gas & Electric Company

By keeping in close touch with the customer's requirements and by planning an installation that would satisfy them, Pacific Gas & Electric Company was able to adapt electric water heating to an unusual situation in the San Joaquin Valley, California, and thereby add 180 kw. of water heating load to its system.

Mandeville Farms, Inc., recently undertook the development of a rich 5,328-acre delta island for purposes of raising potatoes, celery and asparagus. Last spring the island was flooded. Subsequently four old river boats were purchased and used for reclamation pumping by means of their paddle wheels.

With the establishment of six camps on the island, the idea of using the abandoned river-boat boilers for hot water supply was conceived. Four 7½-kw. Wesix side arm heaters were installed for each camp, which accommodates a minimum of 100 employees.

The hot water supply will take care of bath houses, cook houses and bunk houses. Eight foremen's houses are supplied separately, each with a 3-kw. Thermador 30-gal. automatic, insulated unit.

The river-boat boilers were mounted on timber structures and varied in capacity from 850 to 3,200 gal. The picture above shows one of the boilers with battery of electric heaters being installed. Later a timber box framework was constructed around the boiler, sided in and filled with sawdust, thus providing a minimum 12-in. heat insulation.

This arrangement provided the farms with convenient service and an inexpensive installation. Working with the author in laying out and selling this installation was H. C. Hopkins, domestic crew captain for the San Joaquin division of Pacific Gas & Electric.

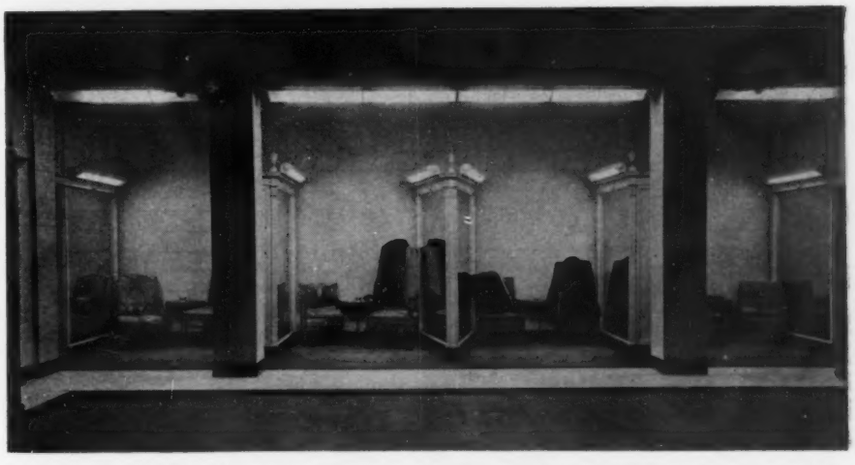
•

New Fluorescents Aid Fur Sales

Increased sales rate resulting from a recent installation of daylight fluorescent lamps in the customers' fitting booths is reported by H. Jaeckel & Sons, fashionable Fifth Avenue furriers of New York City.

The new lighting system, which supersedes a tungsten lamp installation, was designed and installed by the Barkon-Frink Company, in collaboration with General Electric lamp department engineers. It employs two 20-watt daylight fluorescent lamps in each strip over the fitting mirrors and at each end ceiling trough. The center ceiling trough is equipped with six 30-watt fluorescent lamps of the same color.

The excellent daylight-color quality of the new lighting has proved to enhance greatly the appearance of the furs, lending a richness and luster heretofore impossible to obtain with tungsten lamp fixtures. At the same time perfect matching of fur pelts is readily revealed by the improved color-correction qualities of the new fluorescent units. In addition, decreased temperatures in the fitting booths, making for greater customer comfort, have been effected by the installation, since the new fluorescent lamps emit only one-fourth the radiant energy of the tungsten lamps formerly used.

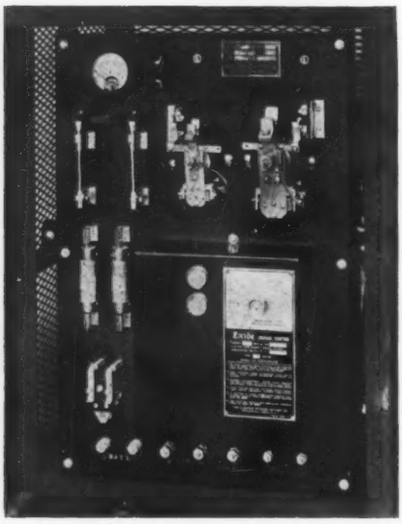


Fluorescent installation of New York furrier consists of two 20-watt daylights over each mirror and in each end trough and six 30-watt lamps in center trough

New EQUIPMENT AVAILABLE

Battery-Charging Control

Increased battery life and greater economy of charging current are claimed advantages of a new unit to control automatically the amount of charge given stationary batteries. Within the cabinet of the charge control a small, self-starting synchronous motor-driven interval time switch—operating from a 60-cycle a.c. supply—starts the charge or increases it once every hour by resetting a temperature compensated (TVR) relay, which, in turn, operates an auxiliary relay. As soon as the



Model "ES" charge control; for use with bulb or dry disk types of rectifiers, d.c. generators or d.c. bus with charging resistors. **Electric Storage Battery Co.**, Philadelphia, Pa.

battery voltage rises to the TVR relay operating voltage the contacts of the latter open, de-energizing the auxiliary relay, which opens its contacts to stop the charge. A continuous-charge toggle switch is also provided.

•

Rust Prevention

"Rust-Ban"' protective coatings. **Standard Oil Co. of N. J.**, New York, N. Y.

New industrial coatings for rust prevention applications contain not only various conventional petroleum ingredients which act as a protection against rust but also make use of a new and special rust inhibitor said greatly to increase this protection. Various grades and types are offered, including a semi-hard drying coating for indoor or outdoor protection of surfaces exposed to corrosive conditions, a fluid coating for protection for indoor storage in humid or acidic atmospheres, a semi-fluid, non-drying type for indoor or outdoor use to be applied by dip, brush or swab to large machinery and similar products, and hard-drying aluminum coatings.

•

Gas-Filled Cable

Low-gas-pressure cable is said to require less insulation, for a given conductor size, than the solid type; hence gas-filled cables of a higher rating can be substituted for solid types on existing duct systems without enlargement of manholes. Resembling oil-filled cable, the new cable differs in that the channel spaces are drained before the cable leaves the factory and the system filled with nitrogen gas under moderate pressure.

Gas-filled cable. **General Electric Co.**, Schenectady, N. Y.

•

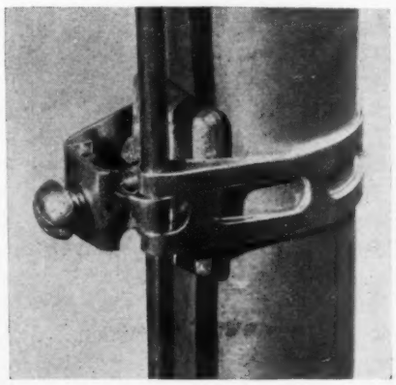
Industrial Timers

Series "2800," Type "2803" vernier-set timers; contacts carry 30 amp. at 110 volts a.c.; dial ranges available vary from 0 to 2 to 0 to 60 minutes. **Automatic Temperature Control Co.**, Philadelphia, Pa.

Accurate and visible timing adjustment is claimed for a new timer which employs vernier scales. Various industrial operations and processes are included in the suggested applications of the timer, such as automatic machinery, molding and extrusion presses and the timing of furnace operation. Four arrangements of load circuits are possible; all types use the "Telechron" motor.

Cable Clamp

A strap-type flexible clamp for grounding lead-covered power or telephone cable without sweating a connection into the lead sheath is a recent addition to this



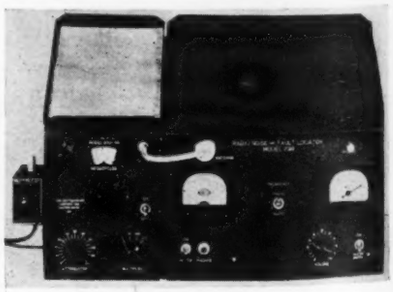
Cable sheath bonding clamp. **James R. Kearney Corp.**, St. Louis, Mo.

company's line. Perforated copper strap fits around the cable, when the saddle, which protects against damage to the cable, is screwed into solid position against the cable. Two size straps for 1.78- and 3.11-in. maximum diameter cable can be supplied; they may be adjusted to smaller diameters by lapping back the excess length.

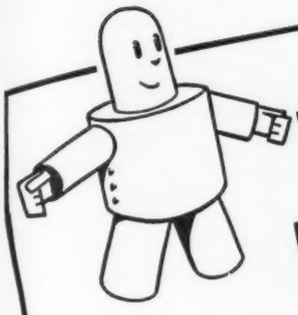
•

Radio Noise Locator

Offered for rapid, accurate identification of radio interference sources, this improved noise and fault locator is sensitive to noises in the 500- to 1,500-kc. broadcast band and also responds to noises somewhat below this band. A collapsible rod antenna for mounting on the locator or outside the automobile on which it is used provides



Model "239" radio noise and fault locator, shown in combination with Model "233-SG" calibrator which permits use of locator for measuring interference intensity. **Tobe Deutschmann Corp.**, Instrument Div., Canton, Mass.

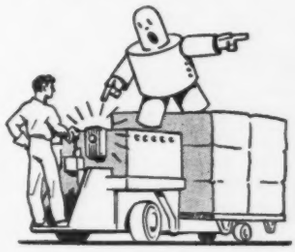


THE EXIDE ROBOT BATTERY TENDER

now guards the performance of electric industrial trucks

A new battery discharge and charge control system that

SIGNALS WHEN A BATTERY NEEDS RECHARGING



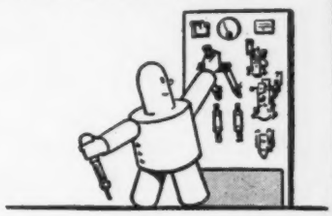
THE Exide Robot Battery Tender is a new discharge and charge control system embodying two recent Exide developments—the Exide Discharge Indicator which mounts on your electric truck, and the Exide Charge Control Unit which is installed on your charging panel.

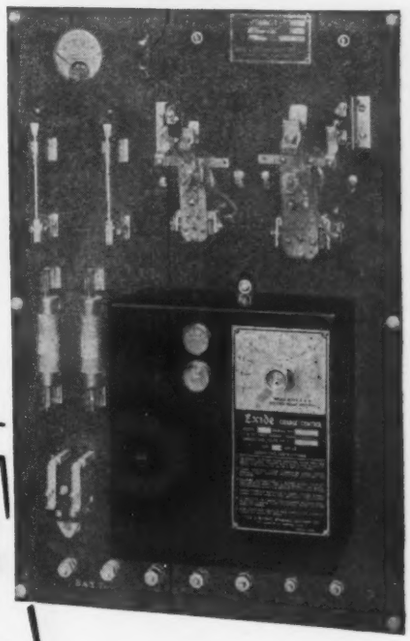
The Discharge Indicator flashes a red signal-light from the truck when the battery is approaching the discharge point and needs recharging or replacement with a freshly charged battery. No longer can your trucks "drag their feet" or run low in power without warning.

The Exide Charge Control Unit automatically controls the recharging of any Exide Motive Power Battery of any number of cells up to 66, and can be used for either two-rate or taper charging. All that is necessary is to insert the charging plug and reset the control knob on the unit. A white signal-light on the unit flashes on, indicating that charging has begun.

At the proper point, the unit reduces the charging rate—automatically. And when charging is complete, the white light is extinguished and a green light appears. This is your "go" signal, meaning that the battery is ready for service and that the charging circuit is available for another battery. These two new Exide developments mean a real improvement in electric truck performance which will result in better material handling and lower cost. Write now for further details.

CONTROLS THE RECHARGE . . . . AUTOMATICALLY





Exide
IRONCLAD BATTERIES
With Exide MIPOR Separators
"MIPOR," Reg. U.S. Pat. Off.

THE ELECTRIC STORAGE BATTERY COMPANY, Philadelphia
The World's Largest Manufacturers of Storage Batteries for Every Purpose
Exide Batteries of Canada, Limited, Toronto

for non-directional pick-up. Output indication is given by a built-in, moving coil loudspeaker and a meter.

•

Industrial Electron Tube

"Permatron" control tube. **Raytheon Production Corp.**, Newton, Mass.

An externally controlled magnetic field controls the starting of the discharge in this new gas-filled control tube. In practice, this control may remain insulated from the tube and its associated power circuit. Suggested potential applications include welding, elevator leveling, communication and electrical instruments.

•

Lineman's Belt

New body belt for linemen consists of two separate parts—a wide leather pad carrying the "D" rings to which the safety strap is attached and the belt proper. The two parts are assembled by slipping

"Virginia" belt. **Davis Emergency Equipment Co.**, New York, N. Y.

the belt through the rings and a loop on the back of the pad. By reversing belt and attachments, the assembly of tape, glove and tool holders can be arranged to suit either right- or left-handed wearers. Since pad and belt are separable, the belt may be adjusted to suit the user.

•

Textile Lighting Fixture

Designed in accordance with the findings of the Illuminating Engineering Society's committee on industrial and school lighting, this fixture utilizes a large-area, Alzak aluminum reflector to deliver uni-

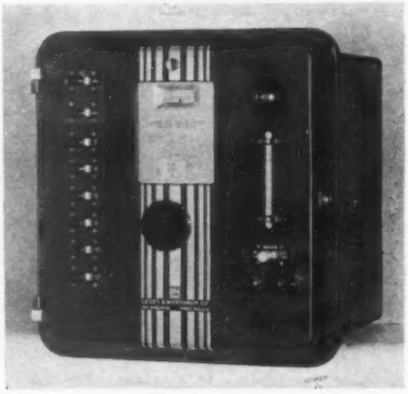
"Equalux" reflector. **Benjamin Electric Mfg. Co.**, Des Plaines, Ill.

form illumination from a silver-bowl Mazda lamp over a restricted area 54 inches in diameter. Skirt of the porcelain-enameled housing of the reflector serves to shield against glare as well as to direct light outward to soften the edge of the lighted area. Intended primarily for textile loom lighting applications, the unit is said to deliver an average of 55 foot-candles over the 54-in. diameter area of the loom, using a 200-watt lamp mounted 9 ft. 6 in. above the loom.

•

Temperature Indicator

Space for toggle-type switches, for connecting any one of a number of thermocouples to the measuring circuit, is provided in a new temperature indicator. In-



Switchboard model temperature indicator with self-contained toggle switches. **Leeds & Northrup Co.**, Philadelphia, Pa.

stalled at a convenient point, the device enables an operator to measure temperatures of near or distant couples, by simply turning a knob, until a pointer comes to zero, and reading a temperature scale. Use of a potentiometer-measuring circuit, hand-standardized, but with automatic reference-junction compensation, is said to eliminate uncertainties due to circuit-resistance variables, making measurements of near or far couple equally reliable.

•

TECHNICAL BULLETINS

N.E.M.A. Standards — The National Electrical Manufacturers Association has published the final report of its findings on the current-carrying capacity of rubber-insulated building wire. Data on performance and heat-resistant grades of insulation, as well as code grade, are covered. N.E.M.A. has also released publication No. 38-51, which is titled "NEMA Standards for Vulcanized Fibre" and supersedes a previous edition published in 1935. Information is included on standard grades and colors of vulcanized fibre as well as mechanical and electrical tests for standard grades. Copies of each booklet are available from N.E.M.A., 155 East 44th St., New York, N. Y. at 25 cents per copy.

Central Station Boilers—Historical highlights as well as 52 pages of drawings and data on steam characteristics of, and fuels and firing methods for boiler units in 26 central stations are presented in the booklet "Central Station Boilers," published by the Babcock & Wilcox Co., 85 Liberty St., New York, N. Y. A table gives condensed information on the capacities and pressures of the boilers, furnace characteristics, fuels and firing methods of more than 50 central stations. Copies are available to central station engineers and executives upon request to the company on company letterhead.

Light and Architecture—Illuminating Engineering Society, 51 Madison Ave., New York, N. Y., has released the 1938 edition of "Light in Architecture and Decoration," the ninth in a series of annual reports. Outstanding installations made during that year are pictured and illuminating data included in the 82-page booklet. Commercial installations of various types, including churches and auditoriums, are included. Copies of the booklet are priced at 35 cents each.

Air Conditioning; Cable Sheathing—Two bulletins of the University of Illinois Engineering Experiment Station are numbers 305 and 306. The first of these reports additional results of investigations into summer cooling, with cold water, in the warm-air heating research residence of the university. It is priced at 90 cents. Creep and fracture of lead and lead alloys for cable sheathing are taken up in the second bulletin. In this bulletin Herman Halperin of Commonwealth Edison Co. contributed a chapter on service records and failures of cable sheathing. This bulletin is priced at $1.

Air Capacitors—"Measurement of Relative and True Power Factors of Air Capacitors" is the subject of Research Paper 1138 of the National Bureau of Standards. An a.c. bridge for measuring the differences of power factor of capacitors in the commercial and audio-frequency range is described. Copies may be obtained from the Superintendent of Documents, Washington, D. C., at 10 cents each.

Creep Data—A compilation of high-temperature creep data on ferrous and non-ferrous metals has been issued by the American Society of Mechanical Engineers and the American Society for Testing Materials. The 486 sheets of test data, 273 graphs and 37 tables cover wrought steels and ferrous alloys, cast steels and ferrous alloys and non-ferrous materials. Copies of the publication can be obtained from A. S. T. M., 260 South Broad St., Philadelphia, Pa., or the A. S. M. E., 29 West 39th St., New York, N. Y., at $12 each postpaid in the U. S. and Canada.

Nickel Properties—Technical Bulletin T-15 of the International Nickel Co., Inc., 67 Wall St., New York, N. Y., contains extensive data on the mechanical properties and physical constants of nickel. A section is also devoted to working instructions.

Reconditioning Equipment — Experiences from the floods of 1936, 1937 and 1938 in reconditioning flood-damaged electric equipment are collected in publication No. F13 of the Edison Electric Institute. The problem of reconditioning and processes, methods and specific examples of reconditioning work and preparedness for future floods are subjects discussed at length. Copies may be secured from E. E. I. headquarters, 420 Lexington Ave., New York, N. Y., and are priced at 75 cents to non-members in the U. S.

High-Temperature, High-Pressure Tubing—Technical Bulletin 6–C, a digest of the properties of carbon and alloy steel tubing for high-temperature, high-pressure service, has been issued by the Babcock & Wilcox Tube Company, Beaver Falls, Pa. A revision and enlargement of previous editions, the bulletin covers the general field of high-temperature applications. Separate creep curves for each alloy are an added feature. Requests for the bulletin should be made to the company.

Philco Enters Refrigerator Field; Jones President

Organization of the Philco Refrigerator Co., a subsidiary of the Philadelphia Storage Battery Co., has been announced, with W. Paul Jones of Indianapolis as president. Philco Refrigerator Co. has acquired the manufacturing rights and patents on the "Conservador" refrigerator from Fairbanks, Morse & Co., and has assumed control of the latter's refrigerator plant. The company's president was formerly executive vice-president of the home appliance division of Fairbanks, Morse & Co.

Philco Refrigerator Co. is now engaged in an extensive plant rearrangement program and will spend $50,000 on new machinery and equipment.

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Uptegraff Plant Moves

A location has been secured by R. E. Uptegraff Manufacturing Co. at Scottdale, Pa., to replace with still greater capacity the plant recently destroyed by fire in Pittsburgh. The new location will give the Uptegraff Co. 40,000 sq.ft. of needed floor space in the mills formerly occupied by Carnegie-Illinois Steel Co. at Scottdale, Pa. The work of rehabilitation will be pushed to provide production at the earliest possible date for the accumulated backlog of orders for transformers and it is planned to have the plant in operation in March.

•

Gets City Plant Contract

The city of Winfield, Kan., recently awarded a contract to the Allis-Chalmers Manufacturing Co. for a 2,000 kw. turbo-generator, exciter, condenser and auxiliary equipment for the municipal power plant.

•

Purchases Two New Units

Electric Storage Battery Co., through a subsidiary, has acquired all the outstanding capital stock of the Grant Storage Battery Co. and the Jordan Electrical Manufacturing Co., Minnesota corporations.

•

Duro Declares Dividend

Announcement has been made by the Duro-Test Corp. that at a meeting of directors a stock dividend equal to 4 per cent was declared payable on March 1 to stockholders of record February 21.

Highway Mechanized

LOWERS COSTS

INCREASES SAFETY FOR WORKMEN

INSURES SPEED FOR EMERGENCIES

CONSTRUCTION AND MAINTENANCE EQUIPMENT

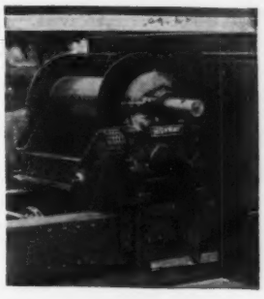
Highway Power Line Construction and Maintenance Equipment is specifically designed for Utility Service. Highway designs come from the field of actual experience. Don't be caught short this winter —equip now with modern Highway Construction and Maintenance Tools.

HIGHWAY EARTH BORING MACHINES

Reduce the time element in every operation and lighten the amount of manual labor. Dig through frozen ground—at different angles—and hard-to-get-at places. Restore storm-wrecked lines to permanent service with less than half the usual delay. Many types and sizes available for mounting on truck or tractor.

HIGHWAY WINCHES

Easier to use . . . smooth operation under heavy duty . . . save costs in time, labor, maintenance . . . there's a type for every need — even light enough for use on 1½- and 2-ton trucks.



HIGHWAY POLE and CABLE REEL TRAILERS

We make a wide line of pole trailer and combination pole and cable reel trailers to economically meet every requirement. See catalog.

HIGHWAY DERRICKS

In sizes and capacities for any height and weight of pole. Safety and dependability under all operating conditions. Easily, quickly assembled and disassembled.

WRITE FOR CATALOG

HIGHWAY ACCESSORIES

Drawbars, Towing Hooks, Automotive Pintle Hooks, Pay Out Reels, Collapsible Power Reels —see catalog for complete descriptions.

HIGHWAY TRAILER CO.
EDGERTON WISCONSIN

News ABOUT PEOPLE

Frank H. Stohr Appointed Manager of Industry Sales

Frank H. Stohr has been appointed manager of all industry sales departments of the Westinghouse Electric & Manufacturing Co. with headquarters

at East Pittsburgh. R. A. Neal has been appointed assistant to vice-president, C. F. Lloyd manager of the central station sales department, and W. A. Furst, formerly general contract manager, as full-time co-ordinator of navy and maritime activities.

Mr. Stohr's appointment marks his third advancement since December, 1937, when he was named manager of the generator division. His promotion as manager of the combined generator and transportation divisions followed last August. He has been associated with Westinghouse since his graduation from the University of Iowa in 1922.

Mr. Neal started in the apprentice course at Westinghouse and advancing in the ranks he was assigned in 1931 the management of the central station sales department. In his new position he will assist the vice-president in connection with price policies and large negotiations. Mr. Lloyd, who succeeds Mr. Neal, has been engaged since joining Westinghouse in work in the power correspondence department and high-voltage transmission operations.

Mr. Furst has been identified with Westinghouse since 1920. He had previously been connected with the Baltimore & Ohio Railroad, Consolidated Gas, Electric Light & Power Co. of Baltimore, Emergency Fleet Corp. and with Lockwood Green Co. of Boston.

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M. C. Turpin New President of Washington Institute

M. C. Turpin, who was recently installed as president of the Electric Institute of Washington, D. C., is well known in Washington's electrical merchandising circles. He previously served two terms as president of the Electric League formed in the earlier days before the organization of the present Electric Institute. He is also well known for his work in connection with the Westinghouse company, which he now serves as merchandising supervisor.

Mr. Turpin, who has been the Westinghouse representative for Washington and vicinity for the past ten years, announced that the Institute would

continue its work and program along the lines it has followed for the past two or three years.

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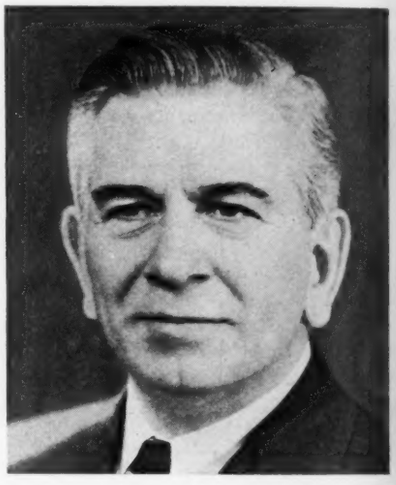
► D. G. PEPPER of Sikeston, Mo., is the new superintendent of the Paragould, Ark., municipal light and power plant.

Norton Leaves Miller Co.; Joins Sight Light Corp.

Guy P. Norton has severed his active connection with the Miller Co., Meriden, Conn., with which he had been connected in an executive capacity



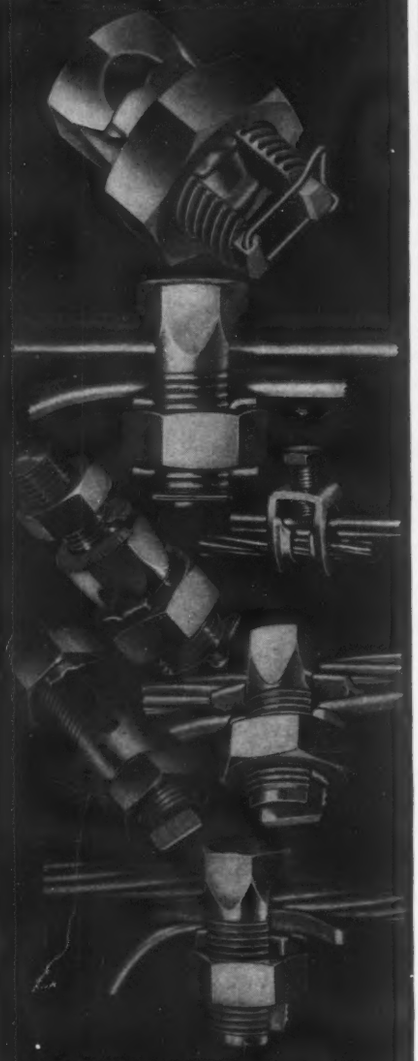
since 1923. He will, however, continue as vice-president and director until such time as his successor is elected. His future activities will be with the Sight Light Corp. of Essex, Conn. Mr. Norton aided Earl Canfield in getting the Sight Light Corp. started, and now that its business has expanded he has decided to give his entire time to it.

Mr. Norton's interest and activity in lighting goes back to the beginning of the century. An ardent promoter of Better Light for Better Sight, he has always been in the foreground of the now rapidly growing movement for the use of sufficient intensity of artificial light to insure clearness of vision and prevention of eye fatigue. In 1922 he toured the country with the original General Electric Company's Lighting Circus. In 1923, when the Duplex Lighting Works of General Electric merged with the Miller Co., Mr. Norton went with them. As one of the executive heads of the Duplex Lighting Works, he played a prominent part in popularizing the Duplexalite fixture and Duplex floor and table lamps. During his connection with the Miller Co. he followed through on the development

STEP UP PERFORMANCE, LENGTHEN USEFUL LIFE
with...
DILECTO
A UNIFORM LAMINATED PLASTIC
Constant laboratory control of every step in the manufacture of DILECTO is the simple answer to its unusual uniformity. But behind that uniformity, so important to the satisfactory performance of your product is an outstanding group of research men. Chemists, Electrical and Radio Engineers, Mechanical Engineers and Metallurgists — all of them working on production and performance problems similar to your own so that the type of DILECTO required for your needs is right all the time. Whether it's improved performance, lower costs or faster assembly that concerns you at the moment, give us the data and we will put our collective heads together and submit suggestions you will find worthwhile.
CONTINENTAL-DIAMOND FIBRE CO., Newark, Del.

Reliable

SOLDERLESS CONNECTORS



Reliable connectors are available for use with all types of conductors. Tap connectors for copper, copperweld, aluminum and steel conductors and for guy strand are manufactured with precision threads to maintain high pressure solderless connections.

Reliable ELECTRIC COMPANY
OVER 25 YEARS SERVICE TO THE UTILITIES
3145 CARROLL AVENUE • CHICAGO ILLINOIS

and sale of this type of lighting unit. Mr. Norton has been a member of the Illuminating Engineering Society for more than thirty years.

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► LOUIS W. FALK has become executive engineer for The Falk Corp., Milwaukee, and W. P. SCHMITTER has been made chief engineer. HAROLD S. FALK, vice-president, continues in his present capacity as director of engineering.

► LOUIS S. CATES, president of the Phelps Dodge Copper Products Corp., received the William Lawrence Saunders Medal of the American Institute of Mining and Metallurgical Engineers, highest award of the organization, at the Institute's recent annual banquet.

► J. H. WALKER, assistant to the engineering vice-president Detroit Edison Co., was named vice-chairman of the committee on research of the American Society of Heating and Ventilating Engineers at the recent annual meeting in Pittsburgh.

► E. CASEY, formerly Denver district manager of the Anaconda Wire & Cable Co., has been transferred to San Francisco, where he will be division manager for the entire West Coast with supervision over the San Francisco, Los Angeles, Seattle and Denver territories.

► O. M. JACKSON, who has served as merchandise manager of the Georgia Power Co. since 1934, has been given the title of sales promotion manager. In this capacity, Mr. Jackson has direct supervision of the merchandise division, and the sales promotional activities of the rural and towns, commercial lighting, dealer co-ordination, load building and wholesale towns divisions of the sales department. Mr. Jackson is responsible for co-ordinating these sales promotional activities.

► WILLIS T. JOHNSON, for the past year district superintendent of operations for the Nevada-California Electric Corp., in the Imperial Valley, Calif., has been appointed to the position of district manager. He will have charge of the new business and commercial department as well as of all Valley electrical operations. Mr. Johnson was formerly general superintendent of the Arizona division of the corporation. WILLIAM MCCULLOCH, formerly Imperial Valley sales supervisor, has been assigned the duties of sales manager. W. L. BENNINGTON, who has been commercial manager for the Imperial Valley, has been transferred to the executive department of the general offices of the corporation in Riverside.

E. Winsnes Named Manager for South America by A-C

Erling Winsnes, manager since 1930 of Sociedad Manufacturers Allis-Chalmers' principal district office at Santiago, Chile, has been appointed by that company as manager for the entire continent of South America with offices in Buenos Aires, Argentina. In that capacity he will supervise and have jurisdiction over all the offices and dealers handling the varied types of power, electrical and industrial machinery designed and built by Allis-

Chalmers, except its tractor and agricultural machinery division products.

Mr. Winsnes first went to South America for Allis-Chalmers during 1918 in sales and engineering work on the west coast. Prior to that he had been connected for some years with the engineering department of that company's mining division in Milwaukee, Wis.

R. E. Diaz has been appointed manager of the district office at Santigao, Chile, to succeed Mr. Winsnes. Ernest Smith will remain in charge of operations in Bolivia with offices at Oruro and W. Gerard Boulton will continue in charge of operations in Argentina, Uruguay and Paraguay where he has been operating in the capacity of sales engineer for many years. His office will remain in Buenos Aires.

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► HOMER M. PACE, vice-president of the South Carolina Power Co., has been appointed by South Carolina's new Governor, Burnet R. Maybank, to serve as one of the three non-legislative appointees on a committee of nine to make a study of the tax structure of that state and recommend to the Legislature its findings. The other members of the committee serving with Mr. Pace consist of three members of the state Senate, three from the House and two other appointees from business and educational life selected by the Governor.

OBITUARY

C. A. Terry

Charles A. Terry, for nearly fifty years counsel, director and vice-president of the Westinghouse Electric & Manufacturing Co., died at his home in New York February 18, after a brief illness. Mr. Terry, who had been retired for several years, was 80 years of age.

An associate of the late George Westinghouse, Mr. Terry had handled some major basic patents, including those dealing with the alternating-current system, transformers, alternating-current motors and steam turbines. A native of South Weymouth, Mass., and a graduate of Amherst and the law school of Columbia University, he decided to specialize in patent law, beginning in the law firm of Franklin L. Pope, a New York patent lawyer. After becoming a partner in the firm of Pope, Edgcomb & Terry, he joined the Westinghouse Electric & Manufacturing Co. Mr. Terry became vice-president in 1919, a position he held until 1931, when he became honorary vice-president.

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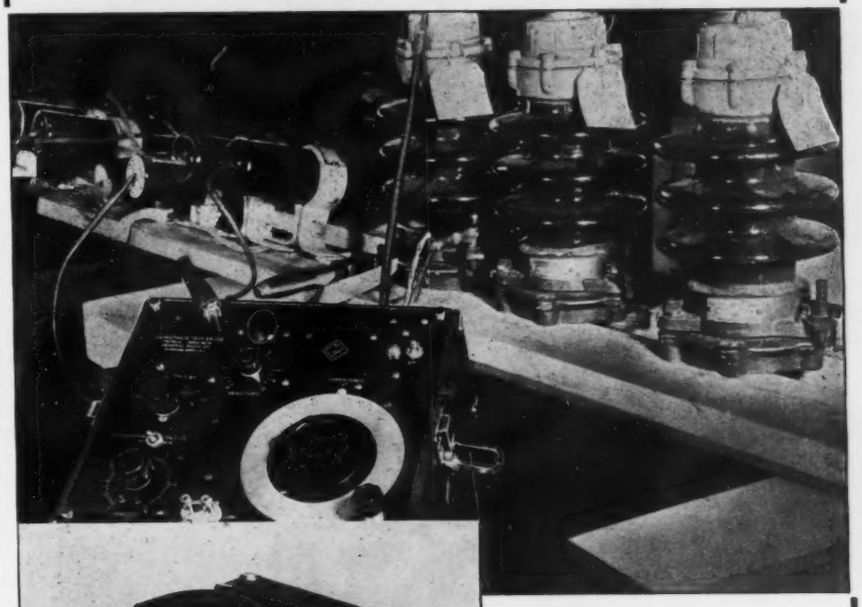
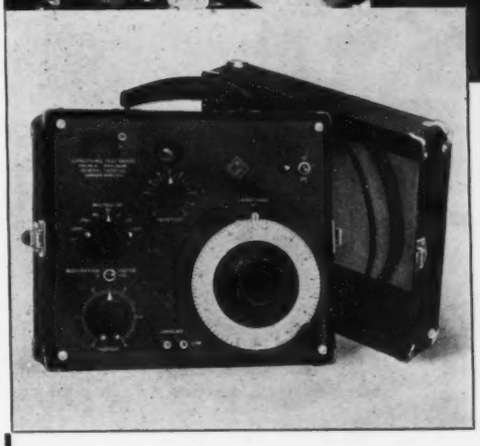
▶HARRISON J. L. FRANK of Detroit, president of the BullDog Electric Products Co., died in Miami Beach, Fla., February 14 after a short illness. He was 58 years old. Mr. Frank had been head of BullDog Electric Products since 1915 and for ten years before that time had been its secretary and general manager.

▶GEORGE M. MARVIN, superintendent of the municipal light and water department in Marshfield, Wis., died December 11 at his home in that city, in his seventy-fifth year. Previous to joining the Marshfield utility in 1924, Mr. Marvin was general manager of the St. Cloud Gas & Electric Co., St. Cloud, Minn., which was later absorbed by the Northern States Power Co.

▶PERCY H. BOOTH, an electrical pioneer and Los Angeles civic leader, died February 8 of a heart attack at his home in that city. Mr. Booth was one of the founders of the Hotpoint Electric Heating Co. in 1904 and supervised construction of the Ontario factory of that organization. He was active in affairs of the company until 1932, when he resigned to attend to personal affairs. The Hotpoint company merged with the Edison Electric Appliance Co. in 1918, when Mr. Booth was made vice-president and Pacific Coast sales manager. He continued his executive activity through the affiliation with the subsequent Edison General Electric Appliance Co. At the time of his death he was president of the Sierra Talc Mining Co.

Testing
Switch and Transformer Bushings





With this Direct-Reading Portable Self-Contained Bridge

Here's a simple, direct-reading bridge for making two very important tests on oil switch and transformer bushings . . . capacitance and power factor. This new General Radio Type 740-BG Capacitance Test Bridge with one unknown terminal grounded is the only portable bridge for these measurements. It is the first moderately priced, portable bridge available to the public utility power field.

This bridge measures capacitance from 5 micromicrofarads to 110 microfarads and dissipation factor ($\frac{X}{R}$) from 0 to 50% *directly*. It is equipped with an electron-ray null indicator which allows accurate balance no matter how noisy the location in which the bridge is used.

In addition the General Radio bridge offers a simple means for measuring the total and direct capacitance between shells of high-voltage insulators, dielectric constant (S.I.C.) and interconductor and conductor-to-shield capacitance of cables and wires; interwinding and winding-to-case capacitance of transformers.

The General Radio Type 740-BG Bridge is completely self-contained with built-in power supply operating from 115-volt 60-cycle line. It is very simple to operate and is moderately priced at $160.00.

Let us show you how you can use this bridge in your measurements!

Write for Bulletin 385 for Complete Information

GENERAL RADIO COMPANY
CAMBRIDGE, MASSACHUSETTS

Manufacturing AND MARKETS

Uptrend Maintained in Laundering Sales

Installation of household laundering equipment in 1938 was the fourth highest in the industry's history. It was the industry's sixth successive 1,000,000-or-more washer year, according to announcement by J. R. Bohnen, executive secretary-treasurer of the American Washer and Ironer Manufacturers Association.

Household washer shipments in December totaled 67,502, compared to 55,843 in December, 1937, an advance of 21 per cent. December ironer total was 9,210, compared to 9,180 a year ago. The year's total of home laundering appliance shipments was 1,248,154 units, 1,137,614 washers, decrease of 31 per cent from 1937, and 110,540 ironers, decrease of 38 per cent. Down trends in laundering appliance sales ended in October and a total close to 2,000,000 units is predicted for this year.

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Electrical Goods Orders Off 32 Per Cent in 1938

Orders booked for electrical goods during 1938, as reported by 78 manufacturers, were valued at $630,801,957, as compared with $930,170,359 for 1937, a decrease of 32.2 per cent, and with $763,430,895 for 1936, a decrease of 17 per cent, according to the Department of Commerce.

During the fourth quarter orders continued the gradual rise of the previous quarters and were valued at $160,374,036, as compared with $158,958,951 in the third quarter and with $182,306,350 for the fourth quarter of 1937.

•

Detroit Electrical Show

Electrical Manufacturers' Representatives' Association of Michigan is now organizing the third Industrial Electrical Show in Detroit's history. It will be held in the Masonic Temple March 29-31. One hundred booths will display the latest in both electrical equipment and supply items. Because this show is industrial in character the committee excludes home appliances or other retail items.

•

Manufacturers Make Sales Appointments

New appointments in the sales organization of the construction materials division of General Electric's appliance and merchandise department, Bridgeport, Conn., have been announced as follows:

Edward Fox, formerly with the G.E. industrial department, New York, has been appointed manager of district No. 2, wiring materials sales, with headquarters in New York. He succeeds F. D. Bedell, who has been appointed supervisor of special wiring device field activities. O. W. Cerny has been appointed manager of district No. 4, wiring materials sales, with headquarters in Cleveland, Ohio. H. A. Cook has been named assistant commercial engineer wiring materials at Bridgeport. He was formerly manager of the miscellaneous construction materials sales section, which has been discontinued.

Other manufacturing companies have made the following assignments:

Anaconda Wire & Cable has appointed A. W. Dunham, Jr., district manager at Denver, Colo., to succeed Ed Casey, who has been made division manager for the entire West Coast. Other changes include the appointment of F. W. Snow, Jr., as manager of the Los Angeles district, succeeding Lloyd Hanlon, who has resigned, and the transfer of Frank Claycomb from the Detroit to the Los Angeles district.

W. A. Hesse & Co., manufacturer of portable and stationary electroplating outfits, Alameda, Calif., has announced the appointment of W. D. Howze Sales Co., Los Angeles, as its representative in southern California and Arizona.

•

O-B Moves Chicago Office

Ohio Brass Co., Mansfield, Ohio, has announced that its Chicago office, formerly located at 20 North Wacker Drive, is now at 1580 Continental Illinois Bank Building, 231 South LaSalle Street.

Adds Two to Board; January Sales Up

Carrier Corp. has elected Frederick S. Fales, vice-president of Socony-Vacuum Oil Co., Inc., and Max McGraw of Chicago, president of the McGraw Electric Co., to the board of directors.

In a preliminary financial report to stockholders J. I. Lyle, president of Carrier, said operations last year resulted in a net loss of approximately $1,061,000 after an inventory adjustment, taxes and depreciation. This compared with a profit of about $600,000 in 1937 after expenses of more than $1,000,000 to cover cost of moving from Newark, N. J., to Syracuse, N. Y.

Air conditioning equipment sold by Carrier during the last two weeks of January called for the largest volume of refrigeration for any half month since 1937. Mr. Lyle stated that more orders for the larger types of air-conditioning machinery were received in that month than in January, 1938.

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January Refrigerator Sales by Westinghouse Set Record

The Mansfield works of the Westinghouse Electric & Manufacturing Co. shipped more electric refrigerators in January than in any other January in the company's history, exceeding shipments for the entire first quarter of 1938, R. C. Cosgrove, manager of household refrigeration, has announced.

"This is a most impressive indication that our business is in a much healthier condition, as normally April and May are the months showing the greatest activity," Mr. Cosgrove said. "We feel that January was not an abnormal month, but rather an indication of a return to the normal activity which the electric refrigerator business has enjoyed in past years. Shipments records are holding up and every indication leads us to believe that the current month will set a new record for February sales."

Lang Sees Improved Outlook for 1939

Report of Crocker-Wheeler Electric Manufacturing Co. for the year ended December 31, 1938, shows net loss of $147,061 after taxes, interest, depreciation, amortization, etc. This compares with net profit in 1937 of $127,283, equal to 44 cents a share on 290,500 no-par shares of capital stock. Net sales for the year were $1,694,133 against $3,269,965.

Current assets as of December 31, 1938, including $97,420 cash, amounted to $1,309,135, and current liabilities, including $255,000 notes payable, were $377,534, compared with cash of $115,706, current assets of $1,442,986 and current liabilities, including $380,000 notes payable, of $569,464 at end of preceding year. Inventories were $881,784, against $964,664.

"During the past year a number of favorable factors have been introduced into the operation of the company." said Edmund Lang, president, in the annual report, "which should be reflected by a better showing in 1939, provided the present somewhat improved outlook materializes and business in general does not receive further unexpected setbacks. . . . Recent announcements indicating that the long-delayed public utility buying program will get under way during 1939 are encouraging. It has been under discussion for many months, but up to the present time no large orders have been placed with electrical manufacturers for any of the equipment which will be required under this program. During 1938 we entered the field of home electrical appliances. In the short period since that date it is indicated that the home appliance division will be a valuable addition to the company's business."

Other manufacturing companies issuing reports follow:

CUTLER-HAMMER—Year 1938, net loss $307,437, against a profit of $1,274,469 in 1937. Current assets on December 31, including $708,779 in cash, amounted to $3,668,320, while current liabilities totaled $346,188.

SQUARE D—Year 1938, net profit, $403,799, equal to $1.17 each on 343,860 common shares of $1 par, compared with $1,062,773 or $3.09 a share, earned the year before.

New York Metal Prices

	Feb. 20, 1939 Cents per Pound	Feb. 15, 1939 Cents per Pound
Copper electrolytic	11.25*	11.25*
Lead Am. S. & R. price	4.75	4.85
Antimony	11.25	11.25
Nickel ingot	35.00	35.00
Zinc spot	4.89	4.89
Tin straits	45.375	45.50
Aluminum, 99 per cent.	20.00	20.00

* Delivered Connecticut Valley.

For Strong–Tight–Easily Made Splices on ALUMINUM CABLE STEEL REINFORCED– use *Nicopress* SLEEVES and TOOLS

Completed A.C.S.R. splice made with Nicopress Splicing Unit

The No. 51 Nicopress Tool used in making A.C.S.R. splices. Only 18" long and weighs but 4 lbs.

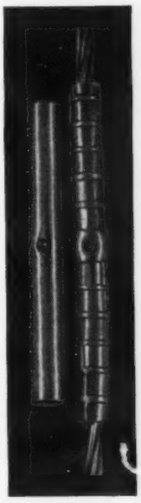
Nicopress Galvanized Steel Sleeve for steel core of A.C.S.R.

Nicopress Aluminum Sleeve for Aluminum Strands of A.C.S.R.

IN splicing A.C.S.R., on new construction or for maintenance, no matter whether you have a large or small amount of this type of work, you will save time and money and get the most ideal splices, by doing the job with Nicopress Tools and special steel and aluminum sleeves. The Nicopress method of splicing A.C.S.R. is highly efficient. The process of making the splice does not injure either the steel core nor the aluminum strands. Every splice is absolutely tight—conductors cannot pull out. High conductivity is assured. Completed Nicopress splices are small, compact and neat and have maximum strength, developing full rated strength of cable. The job of making the splice is simple and easy and effects a very considerable saving of labor. The Nicopress unit for splicing A.C.S.R. consists of the No. 51 Nicopress Tool, steel sleeves for steel core and aluminum sleeve for aluminum strands.

You Can Quickly and Easily Repair A.C.S.R. where 1 to 3 Strands are Broken.. *Do the Job with* *Nicopress* REPAIR SLEEVES

Below Nicopress A.C.S.R. "Jumper" sleeve and completed splice.



Where one to three strands are broken on A.C.S.R. cable you will find the ideal method of repair is by use of Nicopress special A.C.S.R. aluminum repair sleeves. The work is easily and quickly done by fitting sleeve over broken strands and compressing with the No. 51 Nicopress Tool. The operation of splicing does not in any way affect the service. The necessity and expense of additional cable and the time required in making complete new splices is eliminated. Illustration at right shows Nicopress Aluminum repair sleeve for A.C.S.R.—sleeve partially compressed on A.C.S.R. and completed splice.

If you would eliminate the use of clamps and assure maximum conductivity in splicing A.C.S.R. "Jumpers", you will find no better way than by using Nicopress "Jumper" Sleeves. With them, any of your linemen will make tight, strong, neat connections that will stand up under the toughest strains and deliver highest efficiency. Write today for complete details, prices and samples of Nicopress special A.C.S.R. splicing units.

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5 volumes of practical how-to-do-it information

Every man concerned with the care and repair of electrical machinery should have these practical books, with their helpful tables, diagrams, data, methods and kinks. Every one of the five volumes is jammed to the covers with sound, how-to-do-it information—the kind you have to have when anything goes wrong. Liberal use has been made of practical data and practice in repair shops so as to combine the good features of a library of methods with handbook information covering these methods.

Electrical Maintenance and Repair Library

2042 pages, 1721 illustrations and diagrams

These books show you how to

—install all types of motor and generator units;
—locate breaks in armature windings and do a workmanlike job of rewinding;
—know just what is wrong with an electrical machine and take charge of installation and maintenance work;
—making accurate tests of switchboards and apparatus and correctly balance the power with the load;
—handle every sort of wiring job;
—show competence, whether it be in the use of a Stillson wrench or a Wheatstone bridge.

New trouble-shooting book

Now, in addition to four well-known practical books on all details of testing, connecting, rewinding, installing and maintaining electrical machinery, the Library includes Stafford's *Troubles of Electrical Equipment*, a new book full of helpful maintenance information, special trouble-shooting charts, explanation of symptoms and causes of machinery troubles, specific remedies, etc. This revised library gives you the ability to handle bigger jobs with surety of results.

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Field Reports on Business

Business leaders are looking to Secretary Hopkins to break the present log-jam and to bring about a better understanding between industry and government. Some optimism is noted in quarters sensitive to changes. Manufacturers note an increase in inquiries and look for better activity.

NEW ENGLAND

An upward trend in sales of industrial electrical equipment and in general supplies and merchandise is paralleling substantial increases in output of electrical energy as reported by two of the major power systems located in this area. The New England Power Association and subsidiaries reported an increase of 21.34 per cent for last week as compared with 1938 and Boston Edison Co. reported 10.4 per cent increase above the 1938 record for the first week in February.

Small motor sales dominate the industrial market; during the past week one manufacturer sold three 50-hp. d.c. motors to a manufacturer of heavy textile machinery; a group of small motors aggregating 120 hp. was distributed between Massachusetts and Rhode Island machine manufacturers by a prominent representative and inquiries continue to be received in encouraging volume. Small switch and control apparatus sales are advancing; demands for light power control apparatus for institutions are brisk, with sales for the current year to date for one distributor well ahead of 1938.

Lighting apparatus is active; Hotel Statler, Boston, has equipped its "Sandwich Shop" with an installation of fluorescent lamps, including ten main fixtures and nine side brackets, at a total cost of material and wiring of about $1,200. More than 5,000 orders for new fluorescent lamps have been received by one distributor in this district.

A slight bullish tendency in buying small appliances is reported by one distributor. U. S. Army engineers have recommended the construction of a lock and dam with power house on the Connecticut River, Enfield Rapids, at an estimated cost of $12,000,000.

PACIFIC COAST

Contractors report much varied work, with many sizable contracts. School and college construction is particularly heavy with a larger average unit, including a $500,000 PWA high school for Phoenix, a $600,000 high school for Whittier, $400,000 schools for Coachella and Riverside and $450,000 for University of Southern California, the bulk of this work being in the southwest. About $3,000,000 is planned for various junior colleges throughout California, and unless the state Legislature provides funds for an extensive building program 1939 enrollment of University of California will be seriously curtailed. The largest private construction recently announced covers $1,500,000 for rebuilding Arrowhead Springs resort in southern California—destroyed by fire last fall. Several elaborate new motor camps indicate expectations of heavy tourist traffic to San Francisco Exposition.

Much transmission line extension work is reported throughout Pacific Northwest and Rocky Mountain area, ranging from transcontinental divide stretches for government plants to REA jobs. These include a $35,650 award for 50 miles of aluminum line and 100 small transformers in Washington, $60,000 for a 142-mile, 250,000-circ.mil copper line in Wyoming, $32,000 for 52 miles in Colorado.

By Mid-March bids are due for four Central California Valley 103,000-hp. turbines for Shasta power house and four 2,000-kva. disconnect switches with controls, circuit breakers and controls for pumping plants of its delta division.

NEW YORK

The job which Secretary of Commerce Harry Hopkins has cut out for his department of bringing about a better understanding between business and government is expected to loosen the present logjam and stimulate activity. Efforts are being made by the Commerce Department to get business to expand operations and decrease unemployment. The feeling in Washington is that the move promises good business in the future. Utility officials feel that if tangible assurances can be given that the government does not contemplate any more competition with the industry plans can be put into effect to expand facilities. The remarks by President Roosevelt last week that the utility industry has nothing to fear from the government offers the hope that the TVA expansion program will be curbed and that no other projects are being contemplated.

There has been some signs of increasing business activity. Retail sales are tending upward. Manufacturers report an increase in inquiries. Buying is still on the hand-to-mouth basis. Reports are to the effect that three contracts for large turbine units are to be placed soon. These will be followed by orders for other equipment to complete plant expansion.

CHICAGO

Inquiry among representative electrical manufacturers reveals business holding fairly even. Sentiment as a whole reflects considerable optimism over the outlook for spring and summer despite the somewhat disappointing pace business has maintained since the first of the year. Moderate improvement in utility buying has resulted in increased orders for heavy equipment. Sixty per cent of the manufacturers reporting January sales to the Electric Association show an increase over December as well as over January a year ago.

Electrical power output registered a substantial gain over the previous week to a point 12 per cent ahead of a year ago. Dealers report a slight advance in small appliance sales, whereas the larger household items continue to lag.

P.W.A. awards recently made include $526,500 for electrical equipment in schools and public buildings. One manufacturer reports an order for four 5,000-kva. transformers and two large condensers. Other specific orders reported include 3,500 mogul lamp holders, 40,000 ft. No. 8 A.W.G., 600-volt cable and 275 small motors ranging up to 12 hp. Air-conditioning installations are steadily increasing and show a substantial gain over the comparable period last year.

REA Allots Funds; New Contracts Let

REA has recently announced allotments, totaling $7,592,820 for 67 projects in 27 states. This brings allotments made by the Administration since it was established in 1935 to $187,974,030. Among the recent allotments are the following:

FLORIDA—Clay Electric Co-op. Assn., Keystone Heights, Elmer E. Theis, superintendent, $162,000 to build 182 miles of line, 656 members in Alachua, Putnam, Columbia, Marion, Volusia, Union, Levy and Bradford counties.

IOWA—Lyon Rural Electric Co-op., Rock Rapids, Emiel Schuttleffel, president, $138,000 to build 132 miles of line, 318 members in Lyon County. Winnebago Rural Electric Co-operative Assn., Thompson, C. M. Palmer, president, $288,000 to build 258 miles of line, 706 members in Winnebago, Worth and Kossuth counties. Woodbury County Rural Electric Co-op. Assn., Sioux City, C. L. Brown, president, $137,000 to build 119 miles of line, 311 members in Woodbury County. Cherokee County Rural Electric Co-op., Cherokee, Alfred A. Schmillen, president, $130,000 to build 116 miles of line, 288 members in Cherokee County.

KANSAS—Jewell-Mitchell Co-op. Electric Co., Ionia, Ivan L. Rose, superintendent, $155,000 to build 136 miles of line, 313 members in Jewell, Mitchell, Lincoln and Smith counties.

KENTUCKY—Jackson Purchase Rural Electric Co-op. Corp., Paducah, Carmel D. Harris, superintendent, $184,000 to build 150 miles of line, 784 members in McCracken, Ballard, Livingston, Carlisle and Graves counties.

LOUISIANA—Washington - St. Tammany Rural Electric Membership Corp., Franklinton, N. E. Taylor, superintendent, $130,000 to build 143 miles of line, 423 members in Washington, St. Tammany and Tangipahoa Parishes.

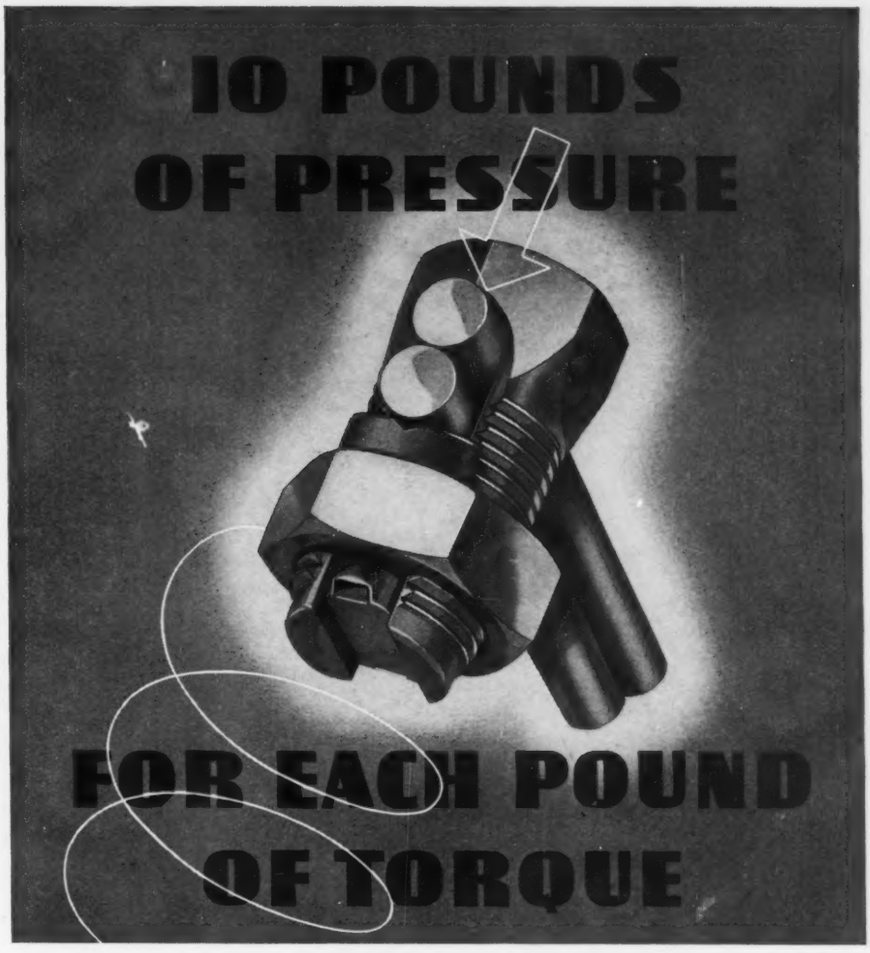
MARYLAND—Choptank Co-op., Denton, Martin C. Voss, president, $144,000 to build 113 miles of line, 426 members in Caroline County.

MINNESOTA—Faribault County Co-op. Electric Assn., Blue Earth, Carl W. Schneider, superintendent, $121,000 to build 100 miles of line, 270 members in Faribault County. Blue Earth-Nicollet Co-op. Electric Assn., Mankato, E. M. Nash, superintendent, $294,000 to build 279 miles of line, 696 members in Blue Earth, Sibley, Nicollet, LeSueur and Faribault counties.

MISSISSIPPI—Hancock Electric Power Assn., Bay St. Louis, Carl R. Vickers, superintendent, $146,000 to build 179 miles of line, 518 members in Harrison and Pearl River counties. Magnolia Electric Power Assn., Magnolia, G. H. Alford, president, $247,000 to build 272 miles of line, 1,054 members in Pike, Walthall, Lincoln and Amite counties.

MISSOURI—Osage Valley Electric Co-op. Assn., Butler, Byron Pipes, president, $375,000 to build 352 miles of line, 1,090 members in Bates, Cass and Henry counties. Central Missouri Electric Co-op., Sedalia, Thomas J. Raines, president, $400,000 to build 385 miles of line, 1,203 members in Pettis and Saline counties.

NEBRASKA—Madison County Rural Public Power District, Battle Creek, Frank Malone, president, $280,000 to build 274



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L-M Connectors grip your conductors in a firm, permanent, vibration-proof contact because they are perfectly machined. Their surfaces are **smooth**, their threads are **clean-cut**. And L-M Connectors **hold** their grip. Built of special high strength copper alloy, they refuse to bend even under the highest service pressures . . . resist corrosion, too. That's why you can **re-use** an L-M Connector again and again, year after year, and get a perfect contact every time.

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New York Chicago Cleveland Pittsburgh Detroit
Boston Richmond Philadelphia Los Angeles

miles of line, 662 members in Madison, Boone, Stanton and Platte counties.

OKLAHOMA—Consumers Rural Electric Co., Kingfisher, Earl Harrison, acting manager, $290,000 to build 318 miles of line, 786 members in Kingfisher, Canadian, Blaine, Oklahoma, Custer, Logan, Dewey and Major counties. Northeast Oklahoma Electric Co-op., Vinita, Howard E. Freeman, president, $275,000 to build 279 miles of line, 833 members in Craig, Ottawa, Mayes and Delaware counties.

PENNSYLVANIA — Central Pennsylvania Rural Electric Co-op. Co., Parkers Landing, Walter Oeltgen, acting supervisor, $154,000, of which total $71,000 will be used to build 52 miles of line, 305 members in Clarion County, the remaining sum of $83,000 will be used for the completion of the present construction.

SOUTH CAROLINA—South Carolina State Rural Electrification Authority, Columbia, U. X. Cullum, chief engineer, $247,000 to build 279 miles of line, 1,000 members in Richland, Allendale, Clarendon, Chesterfield, Darlington, Williamsburg Marlboro, Fairfield, Dillon, Newberry, Lexington, Colleton, Hampton, Sumter, Orangeburg Calhoun and Charleston counties.

TEXAS—City of Seymour, Municipal Engineering and Finance Co., Dallas, engineer, contract to Walso Engineering & Construction Co., Tulsa, Okla., for building entire project, 126 miles of line, 440 members; bid $78,918.

VIRGINIA—Northern Piedmont Electric Co-operative, Madison, T. A. Jeffries, superintendent, and Wendell Bruce Ray, engineer, contract to Rockingham Construction Co., Harrisonburg, Va., for building first section of project, 147 miles of line, 450 members; bid $128,713.

Construction contracts:

Dixie Electric Membership Corp., Union Springs, Ala., A. M. Redd, supt., contract to Gibson and Robinson Co., Donalsonville, Ga., first section of project, 132 miles of line, 245 members and contract to Way Construction Co., Valdosta, Ga., second section, 216 miles of line, 425 members; bids $178,655.

Southeast Colorado Power Assn., Lamar, Colo., E. G. Rash, supt., contract to Driscoll Construction Co., Pueblo, Colo., another section, 270 miles of line, 778 members; bid $221,348.

Taylor County Electric Membership Corp., Reynolds, Ga., G. L. Cooper, supt., contract to Roy Richards, Carrollton, Ga., another section, 493 miles of line, 1,238 members; bid $254,625.

Menard County Electric Co-op., Petersburg, Ill., A. E. Becker, supt., contract to Cater Construction Co., Kansas City, Mo., another section, 338 miles of line, 703 members; bid $248,800.

Kosciusko County Rural Electric Membership Corp., Warsaw, Ind., William A. Orr, supt., contract to Contracting and Material Co., Evanston, Ill., first section, 332 miles of line, 990 members; bid $246,285.

O'Brien County Rural Electric Co-operative, Primghar, Iowa. Fred H. Steuck, supt., contract to J. P. O'Neill. Inc., Faribault, Minn., entire project, 285 miles of line, 583 members; bid $212,998.

Farmers Rural Electric Co-op. Corp., Glasgow, H. E. Gardner, supt., contract to Killoren Electric Co., Appleton, second section, 201 miles of line, 582 members; bid $127,448.

Southwest Louisiana Electric Membership Corp., Lafayette, H. B. Bowles, supt., contract to John Oman, Jr., Nashville, Tenn., another section, 133 miles of line, 309 members; bid $74,778.

Sales Opportunities

EAST LIVERPOOL, OHIO—Ohio Power Company, Newark, Ohio, has authorized expansion and improvements in system in East Liverpool area, including construction of new 22,000-volt transmission line from Wellsville, Ohio, to that point, connecting with new power substation to be located in East End district, where site has been selected at Ohio Avenue and Bushwick Street; plans for this substation are being completed; improvements in East End, Glenmoor and Second Street substations, with installation of automatic switches, transformer facilities and other equipment; extensions and improvements in local distributing lines for increased capacity, including new line transformers and other line equipment; also for installation of several underground lines in downtown area, replacing present overhead system. Entire project will cost about $225,000 and will be carried out as part of 1939 expansion and development program of company.

WASHINGTON, D. C.—Board of District Commissioner, District Building, receives bids until March 1 for electrical equipment for municipal pumping station on Bryant Street, including circuit breakers, switchboards, panelboards and other apparatus. Also, until March 8, for buildings for new fire alarm central office station at McMillan Park, near Fourteenth Street, N. W.

SPOKANE, WASH.—Washington Water Power Company has plans maturing for new outdoor power substation and switching station at Little Falls generating plant, and will carry out work in conjunction with other new power substations in different localities and extensions in present substation, to cost approximately $225,000, with transformers, switchgear and accessory equipment. A fund of about $70,000 will be used for extensions in high-tension lines in various parts of system. This is part of 1939 expansion program of company.

CHARITON, IOWA—Is arranging a fund of $98,000, through bond issue to be voted February 28, for new municipal electric power plant, including purchase of local station of Peoples Gas & Power Company, and remodeling and improving, with installation of additional equipment. George McCarthy is engineer, in charge.

YOAKUM, TEX.—Shell Petroleum Corporation, Shell Building, St. Louis, Mo., plans installation of motors and controls, air compressors, electric-operated pumping machinery, conveyors and other equipment in proposed new gasoline refinery in Denver oil field area, Yoakum County. Cost estimated close to $500,000.

WAGONER, OKLA.—Verdigris River Hydro-Electric, Inc., care of Carl Matthews, Catoosa (Rogers County), Okla., head, has plans under way for new hydroelectric generating plant on Verdigris River, vicinity of Wagoner, where site has been acquired. Project will include a power dam about 4000 feet long and 75 feet high, with generating station equipped for initial capacity of 10,000-kw. A transmission line will be built, including power substations and switching stations. Entire project is reported to cost about $2,000,000.

PORTLAND, ORE.—J. D. Ross, administrator, Bonneville project, Department of Interior, Portland, receives bids until March 6 for three 4000-kva. outdoor-type transformers, oil-insulated, self-cooled, for installation in power substation at Raymond, Wash. Also, at same time, for three single-phase 2500-kva. transformers, outdoor-type, oil-insulated, self-cooled for installation in power substation at Hood River, Ore.

WAHPETON, N. D.—Otter Tail Power Company, Fergus, Minn., will arrange a fund of about $452,000, from current financing totaling approximately $1,100,000, for addition to Kidder steam-electric power plant at Wahpeton, including improvements in present station, recently referred to in these columns. Work will include installation of new 10,000-kw. steam turbo-generator unit, boilers and auxiliary equipment, with transmission line extensions.

DES MOINES, IOWA—Swift & Company, Oil Mill Division, Union Stock Yards, Chicago, Ill., plans installation of motors and controls, regulators, conveyors and other equipment in new soybean processing mill at East Euclid and Delaware Avenue, Des Moines, where site has been acquired. A power house will be built. Cost over $350,000.

ROCK ISLAND, ILL.—United States Engineer Office, Rock Island, receives bids until March 1 for power, control and lighting system at Lock and Dam No. 14, Mississippi River, including lock lighting system transformers and regulators, incoming line substation, switchboard, remote control switch cabinet, incoming power line, lock grounding system, dam conduit systems, dam power feeders and connectors, dam lighting system transformers and accessories, lock lighting system, navigation lighting system, service bridge lighting system, dam operating house lighting system, storage yard lighting system, portable lighting units, signal system, gasoline-electric standby power unit, tow-haulage unit, central control station service power and lighting system feeders, electric power feeder for auxiliary lock, and complete auxiliary equipment (Circular 187).

OMAHA, NEB.—Nebraska Power Company plans extensions in primary and secondary lines in parts of Washington County, including power substation units and service facilities, for expansion in rural e'ectric system in that area, totaling about 70 miles. Work will begin soon.

DENVER, COLO.—Bureau of Reclamation, Denver, has postponed closing of bids from February 27 to March 14 for four 103,000-hp., vertical-shaft hydraulic turbines, and four oil-pressure, actuator-type governors for turbine units noted, for installation in Shasta power plant, Central Valley project, Calif. (Specifications 823).

WEST HARTFORD, CONN.—Pratt & Whitney Division, Niles-Bement-Pond Company, Capitol Avenue, Hartford, manufacturer of machine tools and small tools, plans installation of motors and controls, switchgear, regulators, conveyors, electric traveling cranes, electric hoists and other equipment in new plant at West Hartford, where large tract of land has been secured. Initial plant will total about 700,000 square feet of floor space. A power house will be built. Work is scheduled to begin early in spring and to be completed in fall. Cost about $1,750,000.

KNOXVILLE, TENN.—Plans extensions in transmission and distributing lines, including improvements in a number of existing lines. Also will build new main power substation and expand facilities at present substations with installation of transformers, switchgear and auxiliary equipment. Entire program is estimated to cost about $1,000,000. Burns & McDonnell Engineering Company, 107 West Linwood Boulevard, Kansas City, Mo., is consulting engineer.

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Linemen's Flare Lights

"Packaged Sunlight" for night repairs and line patrol

A quickly available light—provides brilliant illumination for either 20 or 30 minutes. Not affected by wind, rain or snow.

Linemen's Flare Lights are invaluable during outages or other emergencies when quick illumination is imperative . . . ideal warning signals in case of truck breakdowns or when power lines are down on highways.

Equipped with friction cap ignition for instantaneous lighting — no matches required. Easily lighted in any weather. Linemen's Flares are equipped with spike point and removable handle permitting them to be carried in the hand on line patrol or stuck in a post, tree or pole cross arm. Standard equipment with many electric utilities throughout the United States.

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STANDARD PACKING

No. 3020 20 min. 72 per case—63 lbs.

No. 3030 30 min. 36 per case—32 lbs.

CENTRAL RAILWAY SIGNAL CO., INC.

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NOW IN THE Lowest PRICE RANGE

A HEAVY DUTY GROUND ROD CLAMP

Designed with Pressure Bar to align wire with rod and distribute pressure of set screw over a longer surface, ensuring highest efficiency—Constructed with large set screw to give greater tightening ability — Specify Blackburn Groundgrips on your next order.

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High and Low Voltages

IMPERIAL PORCELAIN WORKS

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SAFE Electrical Cords

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Recent Rate Changes

PHILADELPHIA ELECTRIC CO. has been ordered by the Pennsylvania Public Utility Commission to file a new tariff effective as of March 1, which will reduce gross operating revenue and effect a saving to consumers of $1,650,000 annually. This is the second rate reduction ordered by the state board. The first cut was in October, 1937, effective November 1, 1937, and amounted to $3,107,000 a year.

PACIFIC POWER & LIGHT CO.'s rate schedules have been reduced in Washington and Oregon $200,000 annually according to announcement made by the Public Utilities Commissioner of Oregon and the Washington Department of Public Service. The new rates become effective March 1. Oregon customers will save approximately $110,000, while the rest of the reduction goes to Washington communities served by that company. Average reduction in residential service will be 8 per cent. Commercial customers will save from 9 to 20 per cent. The reduction in rates followed an informal investigation in which company officials co-operated with the Washington and Oregon boards.

POTOMAC ELECTRIC POWER CO.'s residential customers will save $141,500 during the ensuing year as their share of the $394,085 rate cut ordered recently by the District of Columbia Public Utilities Commission. Based on the sliding scale arrangement with the utility, the new rates will be applied to all bills rendered on and after February 3. Commercial customers will receive an aggregate reduction of $252,500. The new schedules are as follows: Residential "A"—for the first 46 kw.-hr. 3.9 cents a kw.-hr.; for the next 80 kw.-hr., 1.7 cents, and for all in excess of 126 kw.-hr., 1.5 cents a kw.-hr. Commercial "E"—For the first 80 kw.-hr., 3.8 cents a kw.-hr.; for the next 400 kw.-hr., 2.3 cents; for the next 5,220 kw.hr., 2.1 cents; for the next 33,050 kw.-hr., 1.3 cents; for the next 150,000 kw.hr., 0.7 cents, and for excess over 188,750 kw.-hr., 0.6 cent a kw.-hr.

PUBLIC SERVICE COMMISSION of Puerto Rico has approved a new set of rates for the Porto Rico Railway, Light & Power Co., to be effective for all billings as of January 1. The annual reduction is not less than $275,000.

PUBLIC SERVICE CO. of Colorado's proposal to reduce electric rates to Denver consumers approximately $745,000 a year has been rejected by the Public Utility Committee of City Council. The committee requested Mayor Stapleton to continue negotiations for a more substantial reduction. The proposed reductions would give residential consumers a total saving of approximately $410,000 and commercial consumers, $335,000.

VALLEJO ELECTRIC LIGHT & POWER CO. has put into effect with the approval of the California State Railroad Commission a $35,000 cut in domestic and commercial electric rates. Under the new rate, domestic users will receive an approximate reduction of 7.8 per cent, and commercial users 12.7 per cent.

EL PASO ELECTRIC CO. under an agreement with city officials has put into effect reductions aggregating $87,565 annually in the electric rate charged city consumers. Residential consumers will benefit from 18 to 28 cents a month on their bills, while commercial consumers will be saved from 50 cents to $77.50 a month. New residential rates are 5.5 cents per kilowatt-hour for the first 40 kw.-hr.; 4 cents per kilowatt-hour for the next 60; and 2 cents for each kilowatt-hour over 100, with a minimum monthly bill of 75 cents.

ADAMS ELECTRIC LIGHT CO. has filed a reduction of residential rates with the New York Public Service Commission under which electric consumers of the company in the villages of Adams, Ellisburg and Mannsville and surrounding towns in Jefferson County will save more than $2,500 annually.

•

Municipal Plants

BESSEMER, ALA.—State supreme court has refused to enjoin this municipality and also Tarrant City from constructing electric distribution systems, using TVA power and operating in competition with the Birmingham Electric Co. The Supreme Court upheld Jefferson Circuit Court in dismissing the electric company's complaint. Birmingham Electric sought to restrain the municipalities "from engaging in unfair or unlawful competition" in distribution and selling electric energy in any of the territory it serves, and from issuing bonds to pay for the publicly owned system.

FORT PAYNE, ALA.—An effort to "quash" Alabama Public Works Board approval of issuance of bonds by the city for construction of a municipal distribution plant to use TVA power lost before the State Supreme Court in a 4 to 2 decision. Alabama Power Co. asked a review of the PWA board's action. The power company contended the action of the PWA board was not in the public interest and that losses to all concerned would be larger than any savings to the city. The distribution system would be built with the bond issue, $73,000, and a $59,727 grant by the PWA. The decision said: "The board found that the issuance and sale of the bonds was for the purpose of acquiring by construction or otherwise an electric distribution system and serves a definite and recognized public need and is in the public interest. We do not think that such a finding presents a legal question for review. . . ."

MELBOURNE, FLA.—People of this city rejected a proposal for a municipal electric light plant in a recent election when freeholders of the city voted 336 to 234 against issuance of $350,000 in revenue certificates for the purchase of the distribution system and for construction of a generating plant. Melbourne's franchise held by the Florida Power & Light Co. provides that the city has the right at the end of each five year period to acquire the system. Notice of the city's intention to do so by March 9 was served on the company last September. A subsequent survey and report by Burns & McDonnell, Kansas City engineering firm, indicated a municipal plant would be highly profitable.

MENOMINEE, MICH.—Following its action February 6 rescinding its campaign during the past six years for the establishment of a municipally owned electric light and power plant, the city on February 8 received a $6,983 check from the Menominee & Marinette Light & Traction Co., reimbursing it to date for expenses in promoting the construction of the proposed plant. The utility has also promised a rate reduction of not less than 10 per cent for both residential and commercial users in Menominee and Marinette, which will save customers in the two cities an estimated $27,000 annually.

FORT WORTH, TEX.—On the ground that it would serve no useful purpose, city council has refused to call an election on municipal ownership of the electric and gas

distributing systems. Petitions demanding such an election be called were presented several months ago by Karl Crowley, representing himself and other taxpayers, he stated. The action of the city council followed a report from the city's legal department which doubted the usefulness of calling the election. The city attorney set forth that the council has already the power to purchase light and gas plants and mortgage the franchise and income to finance their acquisition, as would be sought by charter changes proposed as part of the municipal ownership drive the petitioners demanded.

CUERO, TEX.—District Judge J. P. Pool has ruled against the Central Power & Light Co. in a decision that the electorate had voted for a $150,000 municipal electric power distribution system. The utility was contesting the recent city election, alleging more than 500 illegal votes had been cast. Judge Pool sustained 61 challenges but ruled the election had carried by a margin of 24 votes for the proposed system. Walter Lewright, company attorney, gave notice of intention to file an appeal in the Court of Civic Appeals at Galveston.

SUPERIOR, WIS.—Superior Housing Authority in a letter to Howard J. Underhill, general manager of the Superior Water, Light & Power Co., proposed that the Superior utility be sold to the authority for $3,000,000. The offer was made, according to the housing authority, on the premise that utility service is a direct necessity to housing operations and that the authority therefore has a deep and direct interest in municipal acquisition of the utility. City Council has voted to obtain a ruling from the city attorney whether or not the housing authority, which recommended the council's support in its proposed action, has power to negotiate such a purchase and it also voted to call a meeting of the utility purchase committee and officials of the Superior Water, Light & Power Co. to continue their negotiations for a lower utility rate.

•

Buys First Lighting Plant

The world's first commercial electric lighting plant, the invention of Thomas Alva Edison, was auctioned off recently for $2,150 to the Franklin Institute, sole bidder. The plant was assembled by the inventor at Sunbury, Pa., nearly a half century ago. The institute, which has been exhibiting the plant in the Hall of Electrical Engineering since the opening of its museum in 1934, estimates that 1,000,000 persons have seen it.

•

Issues Pictorial Review

Indiana Service Corp. has sent to its commercial and power users a booklet giving a pictorial review of the generating plant and other equipment, as well as an outline of its operations and the men responsible for dependable power service. The sixteen-page pamphlet contains a historical review of the company and the part it has played in the industrial development of Fort Wayne since it was established in April 1882.

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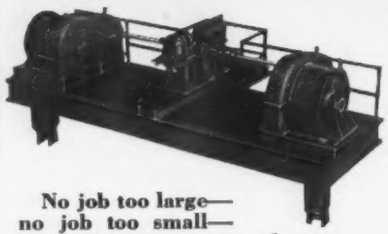

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An Ounce of Prevention

[*Continued from page 53*]

fore associations, clubs, granges, etc., and to thus furnish information as to the company's practices, policies, rates, etc. In carrying this out, invitations from such associations for general talks could be encouraged, with opportunities to use moving pictures to show some of the company's activities and its part in the everyday life of the community. In fact, such gatherings may welcome the opportunity to have such participations in their meetings as a means of breaking the monotony of routine business sessions. Criticisms of utility practices are often spoken of at such meetings and an opportunity to have these answered satisfactorily and promptly by some one whom the members feel to be a part of the community would probably lead to a better understanding and the removal of such criticisms.

There seems to be no reason why employees of utilities should not be encouraged to participate, to the same extent as employees in other forms of industry, in organizations striving for the improvement of civic and business conditions.

The recognition of the importance of women in the economic life of the community and the influence of women's clubs and organizations should not be overlooked. We are informed that more than 70 per cent of life insurance policies make women the beneficiaries, that women spend 90 per cent of the family income and indirectly control another 5 per cent, and that there are more women stockholders in utility stocks than men.

Women important

It is often desirable to employ a woman to maintain contact with the different women's organizations, preferably as a member, and to become active in club work. Interesting exhibits could be shown at various celebrations, fairs, expositions, etc. A company's interest can be shown in those activities in which a large part of the people are particularly interested, such as special football games, better homes expositions and humane or welfare projects, in which cases the company's show windows may be used to advertise the event. It is highly desirable, however, that the utility company's efforts to enlighten its customers with respect to its affairs, as well as its participation in civic or business organizations, should be on a common-sense basis, entirely open and aboveboard. No attempt should be made to carry on covertly or in an obscure manner any form of educational activity which if disclosed may cause resentment or other unfortunate reaction on the part of the public.

In summing up these suggestions, it should be evident that they feature the education of the public by intimate and widespread personal contact between company representatives and the people and by greater participation in the community life and affairs throughout the territory served.

•

Adds Electric Tools to Line of Products

Manufacturing and sales companies of the International Telephone & Telegraph Corp. abroad have entered the field of portable electric tools as a result of a long-term contract arranged between International Standard Electric Corp., which manages the greater part of I. T. & T.'s manufacturing and sales activities and the Cincinnati Electrical Tool Co. of Cincinnati, Ohio.

Under the contract, International Standard Electric Corp. acquires sales and manufacturing rights throughout the world, except the United States and Canada, to the Cincinnati company's products, as well as technical advice and assistance to enable I. T. & T. factories to manufacture portable electric tools abroad under their own trade marks and trade names.

The addition of portable electric tools to its present line of products is a part of I. T. & T.'s general plan for diversification of its sales and manufacturing activities. A complete line of electric refrigerators and air-conditioning units was also added recently.

•

Plans Branch at Chicago

Bridgeport Brass Co., Bridgeport, Conn., has awarded general contract to the Poirot Construction Co., Chicago, Ill., for erection of new one-story factory branch, storage and distributing plant, on site recently leased at St. Louis Ave. and Forty-Seventh Place, Chicago. New structure will provide about 24,680 sq.ft. of floor space, and is estimated to cost about $75,000. Work is scheduled to be placed under way at once and will be completed in three months.

BOOK REVIEWS

Electrical Machinery

By F. A. Annett. Published by McGraw-Hill Book Co., 330 West 42d Street, New York, N. Y. 429 pages, illustrated. Price, $3.

About 100 pages of new material is included in this revised edition of a practical home study course in electrical machinery, originally published as a series of articles in *Power* and later presented in book form in 1921. The work is intended for electricians and power plant operators and plainly fits theory to practice. Included in the new material is an expansion of the chapter on methods of measuring resistance to cover modern megohm meters. A chapter has been added on methods of setting brushes on the modern interpole a.c. machines. The chapters on transformers, alternating-current motors and starting alternating-current motors have been completely rewritten and extended and a chapter has been added on electron tubes and mercury-arc rectifiers, their operation and application.

•

"Sam" Vining's Selling Slants

By Vernon E. Vining. Published by Prentice-Hall, Inc., 70 Fifth Avenue, New York. 106 pages. Price, $1.

"Sam" Vining, director of department store sales of Westinghouse Electric & Manufacturing Company, presents his philosophy of selling in a series of 53 short pieces under titles that range from "inspiration" to "Jitters." A readable book for everybody, not salesmen only, because it impresses as having been talked, not written. In fact, for one who has sat in his audiences, this little book is not so much read as remembered from hearing "Sam" Vining putting his points over. And, although they are titled "Selling Slants," the pieces in this book expound a cheerful philosophy useful in all other walks of life.

•

Energiewirtschaftsfragen

(*Matters Relating to the Economics of Energy Supply in America*)

Issued by Carl Krecka. Published by Frankh'sche Verlags-handlung, Berlin. 205 pages, 50 illustrations. Price 14 Reichsmarks.

The seventeen reports comprising this study of the energy-supply industry in the United States are based on studies made in connection with the visit of the German delegation at the Third World Power Conference in Washington in September, 1936. Econo-

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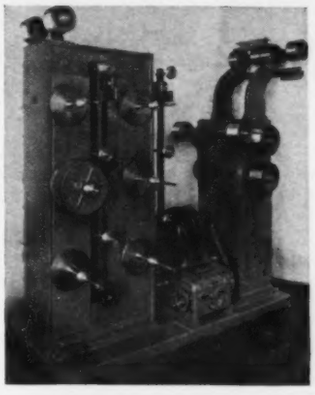

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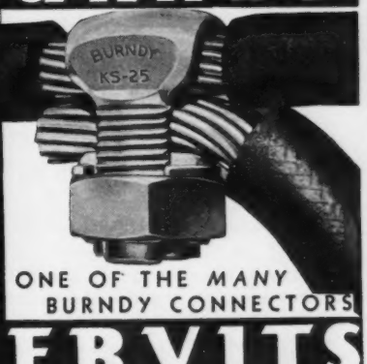

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•

Fractional-Horsepower Electric Motors

By Cyril G. Veinott. Published by McGraw-Hill Publishing Co., 330 West 42d Street, New York. 431 pages, illustrated. Price, $3.50.

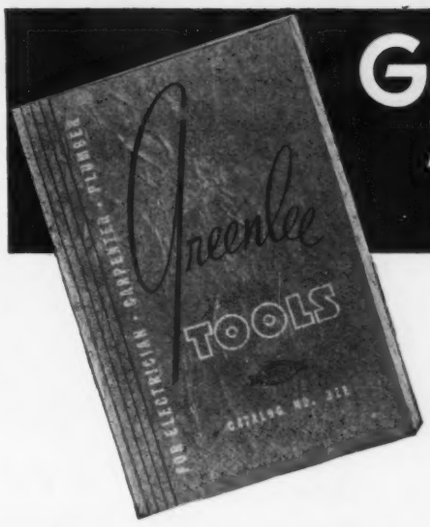
How many kinds of fractional-horsepower motors are there? How do they operate, how much can be expected of them and how are they repaired? Thus somewhat for the designer, this book more serves producer, specifier and user. Forty manufacturers contributed material drawn upon in the text and their motors are identified in a valuable type-designation table; following are the letter codes for other features and characteristics. In taking up the definitions and standards to which motors are built it is unfortunate that ambient temperature was not discussed—it is none too well understood as a datum. Functioning principles, characteristics, winding and rewinding details are taken up for single-phase induction, split phase, capacitor, repulsion-induction, universal, shaded pole, polyphase (fractional), synchronous and direct-current motors. Mechanical features like bearings, mounting, overheating protection, speed reducers are treated in another chapter and testing technique still another. The book closes with a chart of trouble diagnosis.

•

State Board Reports Rate Cuts by Municipal Plants

Consumers of municipally owned electric utilities in New York State have saved more than $1,170,000 annually through rate reductions resulting from proceedings and negotiations initiated by the Public Service Commission since 1932, according to the results of a survey of municipal plants' rates made by the commission.

The annual savings to customers of these municipal plants represent an average of about 9½ per cent of the operating revenue of the utilities. There are at present 51 municipally owned electric utilities in the state.



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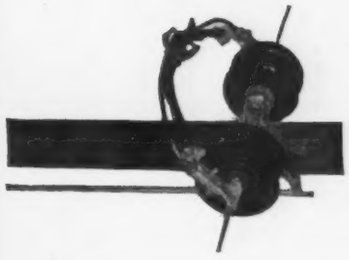

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DISTRIBUTION ENGINEER: Desires new position with utility, manufacturer, or contractor offering more opportunity. Five years general experience with Southern utility in electric distribution work. College graduate, age 27, married. PW-597, Electrical World, 330 W. 42nd St., New York, N. Y.

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